DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

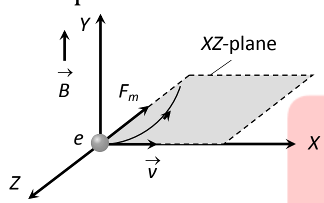
Subject : PHYSICS
DPP No. : 2

Topic :- MOVING CHARGES AND MAGNETISM

1 **(b)**

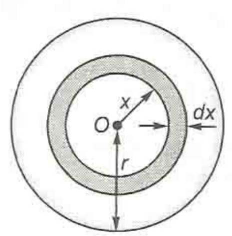
$\vec{F} = -e(\vec{v} \times \vec{B}) \Rightarrow \vec{F} = -e[v\hat{i} \times B\hat{j}] = evB[-\hat{k}]$

i.e. Force on electron is acting towards negative z-axis. Hence particle will move in a circle in xz-plane



2 **(b)**

Consider a hypothetical ring of radius x and thickness kx of a disc as shown in figure.



Charge on the ring, $dq = \frac{q}{\pi r^2} \times (2\pi x dx)$

Current due to rotation of charge on ring is

$di = \frac{dq}{T} = \frac{dq}{1/n} = ndq = \frac{nq2xdx}{r^2}$

Magnetic field at the centre O due to current of ring element is

$$dB = \frac{\mu_0 di}{2x} = \frac{\mu_0 nq2xdx}{r^2(2x)} = \frac{\mu_0 \, nq \, dx}{r^2}$$

Total magnetic field induction due to current of whole disc is

$B = \int_0^r dx = \frac{\mu_0 \, nq}{r^2}(x)_0^2 = \frac{\mu_0 nq}{r}$.

3 **(a)**

The current enclosed with in the circle

$\frac{i}{\pi a^2}$, $\pi r^2 = \frac{i}{a^2}\, r^2$

Ampere's law $\oint \mathbf{B.dl} = \mu_0 i'$ gives

$$B\,.2\pi r = \frac{\mu_0 i r^2}{a^2}$$

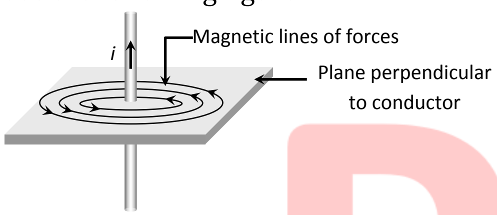
or $\quad B = \frac{\mu_0 i r}{2\pi a^2}$

4 **(a)**

$$B = \frac{F}{m} = \frac{1.5}{7.5 \times 10^{-2}} = 20 \text{ T or } 20 \text{ Wbm}^{-2}$$

5 **(c)**

See the following figure



6 **(d)**

Kinetic energy in magnetic field remains constant and it is $K = q\,V \Rightarrow K \propto q$ [$V =$ constant]

$\therefore K_p{:}K_d{:}K_\alpha = q_p{:}q_d{:}q_\alpha = 1{:}1{:}2$

7 **(c)**

$$B \propto \frac{1}{r} \Rightarrow \frac{B_1}{B_2} = \frac{r_2}{r_1} \Rightarrow \frac{B}{B_2} = \frac{r/2}{r} \Rightarrow B_2 = 2B$$

8 **(d)**

$$Bqv = \frac{mv^2}{r} \Rightarrow r = \frac{mv}{Bq} \qquad \text{...(i)}$$

Since particle was initially at rest and gained a velocity v due to a potential difference of V volt. So,

KE of particle $= \frac{1}{2} mv^2 = qV$

$$v = \sqrt{\frac{2qV}{m}} \qquad \text{...(ii)}$$

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

$$r = \frac{m}{Bq}\sqrt{\frac{2qV}{m}}$$

$$r = \frac{1}{B}\sqrt{\frac{2mV}{q}}$$

$\therefore$ Diameter of the circular path

$$d = 2r = \frac{2}{B}\sqrt{\frac{2mV}{q}}$$

9 **(d)**

The direction of magnetic field is along the direction of motion of the charge particles, so angle will be 0°.

$\therefore$ Force $F = qvB \sin\theta$

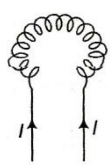
$= qvB \sin\theta$

$= 0 \qquad (\because \sin\theta = 0)$

So, there will be no change in the velocity.

10 **(a)**

Toroid is ring shaped closed solenoid.



11 **(b)**

$B = \frac{\mu_0 ni}{2} = \frac{(4\pi \times 10^{-7}) \times 800 \times 1.6}{2} = 8 \times 10^{-4}$ T.

12 **(b)**

Magnetic field at mid-point M in first case is $B = B_{PQ} - B_{RS}$

($\therefore B_{PQ}$ and B_{RS} are in opposite directions)

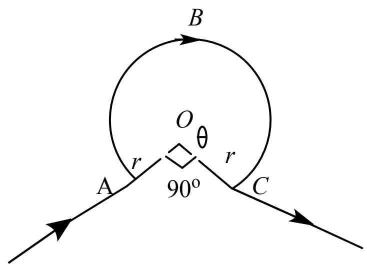
$$= \frac{4\,\mu_0}{4\pi d} - \frac{2\,\mu_0}{4\pi d} = \frac{2\,\mu_0}{4\pi d}$$

When the current 2 A is switched off, the net magnetic field at M is due to current 1 A

$$B' = \frac{\mu_0 \times 2 \times 1}{4\pi d} = B$$

13 **(d)**

Let the given circular ABC part of wire subtends an angle θ at its centre. Then, magnetic field due to this circular part is



$$B' = B_c \times \frac{\theta}{2\pi} = \frac{\mu_0}{4\pi} \times \frac{2\pi i}{e} \times \frac{\theta}{2\pi}$$

$$\Rightarrow B' = \frac{\mu_0}{4\pi} \cdot \frac{i}{r} \theta$$

Given, $i = 40$ A, $r = 3.14$ cm $= 3.14 \times 10^{-2}$ m

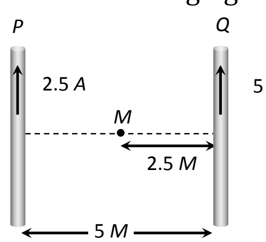
$$\theta = 360° - 90° = 270° = \frac{3\pi}{2} \text{ rad.}$$

$$\therefore B' = \frac{10^{-7} \times 40}{3.14 \times 10^{-2}} \times \frac{3\pi}{2}$$

$$B' = 6 \times 10^{-4} \text{ T}$$

14 **(d)**

In the following figure magnetic field at mid point M is given by



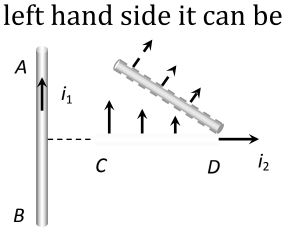
$$B_{net} = B_Q - B_P$$

$$= \frac{\mu_0}{4\pi} \cdot \frac{2}{r}(i_Q - i_P)$$

$$= \frac{\mu_0}{4\pi} \times \frac{2}{2.5}(5 - 2.5) = \frac{\mu_0}{2\pi}$$

16 **(c)**

Since the force on the rod CD is non-uniform it will experience force and torque. From the left hand side it can be seen that the force will be upward and torque is clockwise



17 **(b)**

Circumference = length of the wire

$2\pi r = L$

$r = \frac{L}{2\pi}$

$r = \frac{1}{\pi}$ $\quad (\because L = 2\text{ m})$

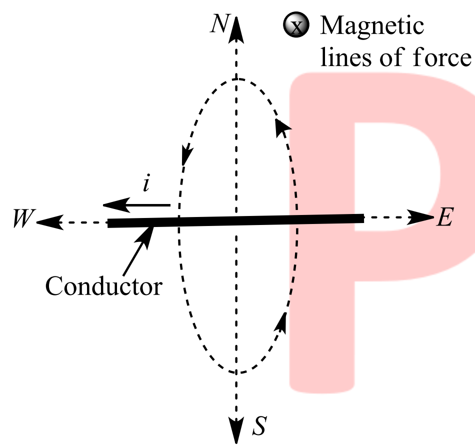
Magnetic moment $M = nIA$

$= 1 \times 1 \times \pi\left[\frac{1}{\pi}\right]^2$

$= \frac{1}{\pi}\text{ Am}^2$

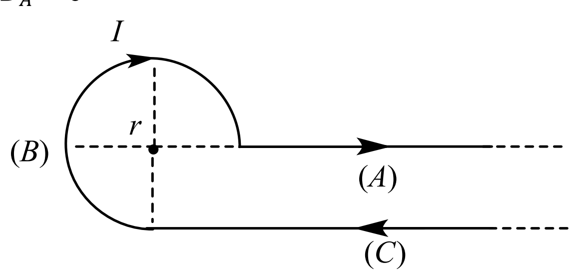
18 **(c)**

According to Maxwell's right hand screw rule, the direction of magnetic field at a point above the conductor is towards north and at a point above the conductor is towards north and at a point below the conductor is towards south.



20 **(a)**

$B_A = 0$



$B_B = \frac{\mu_0}{4\pi}\frac{(2\pi - \pi/2)I}{r} \otimes = \frac{\mu_0}{4\pi}\frac{3\pi I}{2r}$

$B_C = \frac{\mu_0 I}{4\pi r}\otimes$

So, net magnetic field at the centre

$= B_A + B_B + B_C$ $\quad = 0 + \frac{\mu_0}{4\pi}\frac{3\pi I}{2r} + \frac{\mu_0 I}{4\pi r} = \frac{\mu_0 I}{4\pi r}\left(\frac{3\pi}{2} + 1\right)$

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