DPP

DAILY PRACTICE PRODUCTS

Class : XIIth
Date :

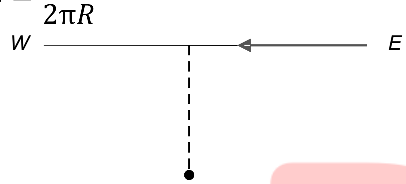
Solutions

Subject : PHYSICS
DPP No. : 3

Topic :- MOVING CHARGES AND MAGNETISM

1 **(c)**

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



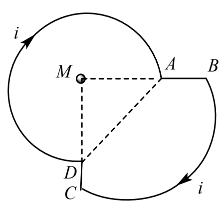
Direction is given by Right hand palm value No. 1

$B = \frac{2 \times 10^{-7} \times 100}{4}$ T towards south

2 **(d)**

(i) Magnetic field at the centre due to the curved portion $DA = \frac{\mu_0 i}{4\pi R}\left(\frac{3\pi}{2}\right)$

According to right hand screw rule, the magnetic field will be into the plane of paper.



(ii) Magnetic field at M due to AB is zero.

(iii) Magnetic field at the centre due to the curved portion BC is $\frac{\mu_0 i}{4\pi 2R}\left(\frac{\pi}{2}\right)$. According to right hand screw rule, the magnetic field will be into the plane of paper.

(iv) Magnetic field at M due to DC is zero.

Hence, the resultant magnetic field at M

$$= \frac{3\mu_0 i}{8R} + 0 + \frac{\mu_0 i}{16R} + 0 = \frac{7\mu_0 i}{16R}$$

3 **(c)**

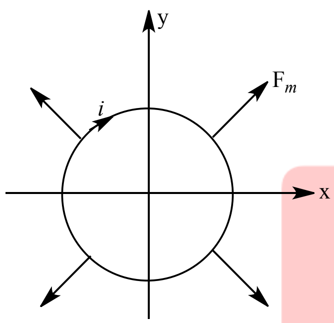
Magnetic field at the centre of the circle

$$B = \frac{\mu_0 i}{2r} \text{ or } B = \frac{\mu_0 q}{2rT}$$

$$B = \frac{4\pi \times 10^{-7} \times q}{2r} n$$

4 **(b)**

Net force on a current carrying loop in uniform magnetic field is zero. Hence the loop can't translate. So, options (c) and (d) are wrong. From Fleming's left hand rule we can see that if magnetic field is perpendicular to paper inwards and current in the loop is clockwise (as shown) the magnetic force $\mathbf{F}_m$ on each element of the loop is radially outwards, or the loops will have a tendency to expand.



5 **(a)**

In adjoining loops of spring, the current being in the same direction, there will be attraction. Due to which the spring gets compressed.

6 **(d)**

The minimum value of magnetic field

$$B = \frac{F}{qv \sin 90°}$$

$$= \frac{10^{-10}}{10^{-12} \times 10^5} = 10^{-3} \text{ T in } z - \text{direction}$$

7 **(a)**

$$r = \frac{mv}{Bq} = \frac{\sqrt{2E_k m}}{Bq}$$

$$= \frac{\sqrt{2 \times 6 \times 10^{-16} \times 9 \times 10^{-31}}}{6 \times 10^{-3} \times 1.6 \times 10^{-19}}$$

On solving $r =$ 3.42 cm.

8 **(a)**

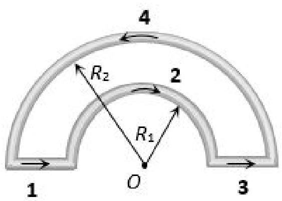
In the following figure, magnetic fields at O due to section 1, 2, 3 and 4 are considered as B_1, B_2, B_3 and B_4 respectively

$B_1 = B_3 = 0$

$$B_2 = \frac{\mu_0}{4\pi} \cdot \frac{\pi i}{R_1} \otimes$$

$$B_4 = \frac{\mu_0}{4\pi} \cdot \frac{\pi i}{R_2} \odot$$ As $|B_2| > |B_4|$

So $B_{net} = B_2 - B_4 \Rightarrow B_{net} = \frac{\mu_0 i}{4}\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \otimes$



9 **(b)**

Here, $i = 4\text{A}; \text{V} = 20$ Volt; so,

$R = \frac{V}{I} = \frac{20}{4} = 5\text{A}$. Since, voltmeter is connected in parallel with resistance R, the effective resistance of this combination is 5 Ω only if the resistance R is greater than 5Ω, since total resistance in parallel combination becomes less than individual resistance.

10 **(a)**

Here, $2l = 3$ cm; $d_1 = 24$ cm, $d_2 = 48$ cm.

As the magnet is short, $\frac{B_1}{B_2} = \frac{d_2^3}{d_1^3} = \left(\frac{48\text{ cm}}{24\text{ cm}}\right)^3 = 8$

11 **(c)**

Force on wire C due to wire D.

$F_1 = \frac{\mu_0 I_1 I_2}{2\pi \ r} l$ (repulsive)

$$= 2 \times 10^{-7} \times \frac{30 \times 10}{3 \times 10^{-2}} \times 25 \times 10^{-2}$$

$$= 2 \times 10^{-7} \times 2500 = 5 \times 10^{-4} \text{ N}$$

Force on wire C due to wire G

$F_2 = \frac{\mu_0 I_1 I_2}{2\pi \ r} l$ (repulsive)

$$= \frac{2 \times 10^{-7} \times 10 \times 20}{2 \times 10^{-2}} \times 25 \times 10^{-2}$$

$$= 2 \times 10^{-7} \times 2500 = 5 \times 10^{-4} \text{ N}$$

Net force $= F_1 - F_2 = 5 \times 10^{-4} \text{ N} - 5 \times 10^{-4} \text{ N} = 0$

12 **(b)**

From Biot-Savart's law the magnetic field (B) due to a conductor carrying current I, at a distance r_1 is

$$B_1 = \frac{\mu_0 I_1}{2\pi r_1}$$

Magnetic field at P due to current in second conductor is

$B_2 = \frac{\mu_0 I_2}{2\pi(r_1 + d)}$

From Fleming's right hands rule the fields at P are directed opposite.

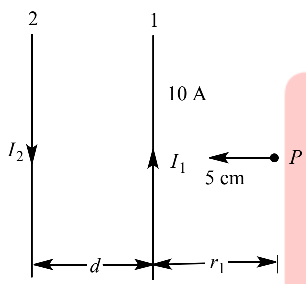
$\therefore$ Resultants, field $B_1 = B_2$

$\therefore \quad \frac{\mu_0 I_1}{2\pi r_1} = \frac{\mu_0 I_2}{2\pi(r_1 + d)}$

Given, $I_1 = 10$ A, $r_1 = 5$, $r_1 + d = 5 + 10 = 15$ cm

$\therefore \quad I_2 = \frac{I_1}{r_1} \times (r_1 + d)$

$I_2 = \frac{10}{5} \times 15 = 30$ A



13 **(b)**

When two infinitely long parallel conductors carrying currents i_1 and i_2 are placed a distance r apart, then force on the unit length of a conductor due to the other conductor is given by

$F = \frac{\mu_0}{4\pi} \frac{2 i_1 i_2}{r}$

Here, $i_1 = i_2 = i$ and $r = b$

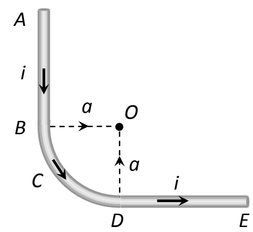
$\therefore F = \frac{\mu_0 i^2}{2\pi b}$

14 **(d)**

The field at O due to AB is $\frac{\mu_0}{4\pi} . \frac{i}{a} \hat{k}$ and that due to DE is also $\frac{\mu_0}{4\pi} . \frac{i}{a} \hat{k}$

However the field due t BCD is $\frac{\mu_0}{4\pi} . \frac{i}{a} \left(\frac{\pi}{2}\right) \hat{k}$

Thus the total field at O is $\frac{\mu_0}{4\pi} . \frac{i}{a} \left(2 + \frac{\pi}{2}\right) \hat{k}$



15 **(b)**

$B = \mu_o n i$

16 **(b)**

$B = \frac{40}{4\pi} \times \frac{\pi i}{r} = 10^{-7} \times \frac{\pi \times 10}{20 \times 10^{-2}}$ 5πμ tesla

17 **(d)**

Cyclotron frequency, $v = \frac{Bq}{2\pi m}$

$\Rightarrow \quad v = \frac{1 \times 1.6 \times 10^{-19}}{2 \times 3.14 \times 9.1 \times 10^{-31}}$

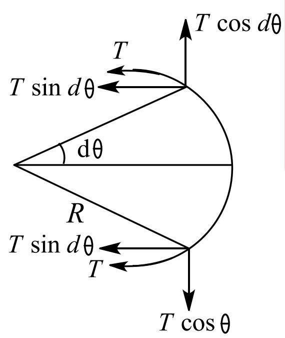
$= 2.79 \times 10^{10}$ Hz $\approx$ 28 GHz

19 **(d)**

If force on the electron due to electric field is equal and opposite to the force on electron due to magnetic field, then electron will go undeflected.

20 **(a)**

For small element proton



$2T\sin d\theta = 2R\, d\theta$ iB

$2T d\theta = 2Ribd\theta$

$T = iRB$

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