DPP

DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 1

Topic :- MOVING CHARGES AND MAGNETISM

1 **(c)**

Frequency $f = \frac{Bq}{2\pi m}$

As proton, electron, Li^+, He^+ have same charge in magnitude and since magnetic field is also constant.

So, $f \propto \frac{1}{m}$

Among the given charged particles, Li^+ has highest mass, therefore it will have minimum frequency.

2 **(b)**

The magnetic field produced at the centre of the circular coil carrying current is given by

$$B = \frac{\mu_0 NI}{2r}$$

For one turn $N = 1$

$$B_0 = \frac{\mu_0 I}{2r}$$

As the coil is rewound

$$r' = \frac{r}{3}, \quad N' = 3$$

$$\therefore B' = \frac{\mu_0 I \times 3}{2 \times \left(\frac{r}{3}\right)}$$

$$= \frac{9\mu_0 I}{2r} = 9B_0$$

3 **(b)**

$F = qvB$ also kinetic energy $K = \frac{1}{2}mv^2 \Rightarrow v = \sqrt{\frac{2K}{m}}$

$$\therefore F = q\sqrt{\frac{2K}{m}}B$$

$$= 1.6 \times 10^{-19} \sqrt{\frac{2 \times 200 \times 10^{6} \times 1.6 \times 10^{-19}}{1.67 \times 10^{-27}}} \times 5 = 1.6 \times 10^{-10} N$$

4 **(b)**

$$B = \frac{\mu_0}{4\pi} \times \frac{2\pi N i R^2}{(R^2 + x^2)^{3/2}} \Rightarrow B \propto \frac{1}{(r^2 + x^2)^{3/2}}$$

$$\Rightarrow \frac{8}{1} = \frac{(R^2 + x_2^2)^{3/2}}{(R^2 + x_1^2)^{3/2}} \Rightarrow \left(\frac{8}{1}\right)^{2/3} = \frac{R^2 + 0.04}{R^2 + 0.0025}$$

$\Rightarrow \frac{4}{1} = \frac{R^2 + 0.04}{R^2 + 0.0025}$. On solving $R = 0.1\ m$

5 **(d)**

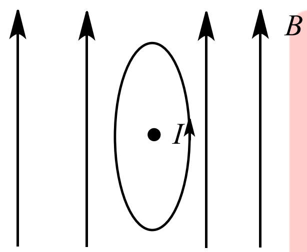
Torque (τ) acting on a loop placed in a magnetic field B is given by

$\tau = nBIA \sin \theta$

Where A is area of loop, I the current through it, n the number of turns, and θ the angle which axis of loop makes with magnetic field B.

Since, magnetic field (B) of coil is parallel to the field applied, hence $\theta = 0°$ and $\sin 0° = 0$

$\therefore\ \ \tau = 0$



6 **(a)**

Magnetic field at the centre of circular coil

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

I and r being the current and radius of circular coil respectively.

or $I = \frac{4\pi}{\mu_0} = \frac{r B_H}{2\pi n}$

$$= \frac{10^7 \times 0.1 \times 0.314 \times 10^{-4}}{2 \times 3.14 \times 10} = 0.5\ \text{A}$$

7 **(c)**

As shown in the following figure, the given situation is similar to a bar magnet placed in a uniform magnetic field perpendicularly. Hence torque on it

$\tau = MB \sin 90° = (i\pi r^2)B$

9 **(d)**

Cyclotron frequency is given by

$$v=\frac{qB}{2\pi m}$$

$$\therefore v=\frac{1.6\times10^{-19}\times6.28\times10^{-4}}{2\times3.14\times1.7\times10^{-27}}$$

$$=0.94\times10^{4}\approx10^{4}\text{ Hz}$$

10 **(c)**

Force on the charged particle in electric field, $F=qE$; acceleration of particle, $a=F/m=q\,E/m$; using the relation $v^2=u^2+2a$, we have $v^2=0+2(qE/m)y$

Or $\frac{1}{2}mv^2=q\,E\,y$; so KE is $q\,Ey$.

11 **(b)**

Radius of circular path

$R=\frac{mv}{qB}$

But $mv=\sqrt{2mqV}$

$$\therefore R=\frac{\sqrt{2mqV}}{qB}\quad\text{or } R\propto\sqrt{m}$$

or $\frac{R_1^2}{R_2^2}=\frac{M_1}{M_2}$

or $\frac{M_1}{M_2}=\frac{R_1^2}{R_2^2}=\left(\frac{R_1}{R_2}\right)^2$

12 **(d)**

The charge moving on a circular orbit acts like the current loop. Magnetic field at the centre of the current loop is $B=\frac{\mu_0 2\pi\,I}{4\,\pi\,R}$

$$B=\frac{\mu_0 2\pi\,q\,v}{4\,\pi\,R}\ \textbf{or}\ R=\frac{\mu_0 2\pi\,q\,v}{4\,\pi\,B}$$

Substituting the given values, we get

$$R=\frac{4\pi\times10^{-7}\times2\pi\times2\times10^{-6}\times6.25\times10^{12}}{4\pi\times6.28}=1.25m$$

13 **(c)**

As, $qV=\frac{1}{2}mv^2$ or $v=\sqrt{\frac{2qV}{m}}$; when particle describes a circular path of radius R in the magnetic field

$$q\,v\,B=\frac{mv^2}{R}\qquad\text{or}\quad R=\frac{m\,v^2}{q\,v\,B}=\frac{m\,v}{q\,B}$$

Or $R=\frac{m}{q\,B}\sqrt{\frac{2\,q\,V}{m}}=\frac{1}{B}\sqrt{\frac{2\,V\,m}{q}}$

$$ie,\qquad R\propto\sqrt{m}\qquad\therefore\frac{m_x}{m_y}=\left(\frac{R_1}{R_2}\right)^2$$

14 **(b)**

$$i=\frac{k}{n\,BA}\theta\quad\text{or }\theta=\frac{n\,BA}{k}\ ie,\theta\propto n.$$

15 **(b)**

To convert a galvanometer into a voltmeter, a resistance $R = \frac{V}{i_g} - G$ is connected in series of it.

To convert galvanometer into an ammeter, a resistance $S = i_g G/(i - i_g)$ is to be connected in parallel of galvanometer.

16 **(d)**

For a point at a distance $x = +a$, the angle between $d\vec{l}$ and $\vec{r}$ is zero. Hence, $d\vec{l} \times \vec{r} = 0$.

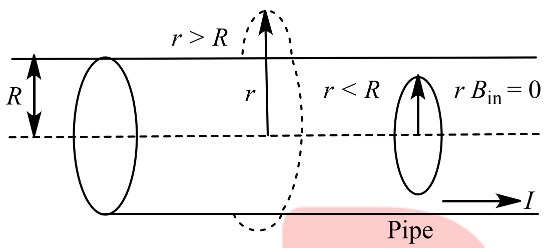
17 **(d)**

By Fleming's left hand rule

18 **(c)**

Required arrangement is shown in figure. According to Ampere's circuital law

$B_{out} = \frac{m_0}{4p}\frac{2I}{r}$



For an internal point, $r < R$

$B_{internal} = \frac{\mu_0(0)}{2\pi r} = 0$

For a point on the pipe, $r = R$

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

For an external point, $r < R$

$B_{external} = \frac{\mu_0 I}{2\pi r}$

Therefore, option (c) is correct.

19 **(d)**

The magnetic field at any point on the axis of wire be zero

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10

A.	C	B	B	B	D	A	C	A	D	C
Q.	11	12	13	14	15	16	17	18	19	20
A.	B	D	C	B	B	D	D	C	D	D