Image

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Pharmacy

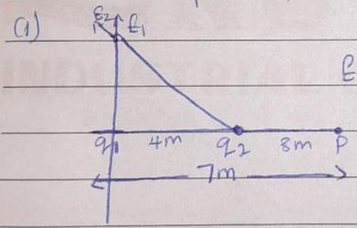
Memo

(2) electric field and electric field intensity

electric field	electric field intensity
A region of Space around the electric charge in which electric force acts on	The measure of the Strenght of an electric field at any point also a force per Unit charge.

(2b) $q_1 = 8nc$ at Origin
$q_2 = 12nc$ on axis at $x = 4m$.
1) net electric field at point P on the axis at $x = 7m$
while on point Q on the y axis at $y = 3m$ due to the charges.

(i)

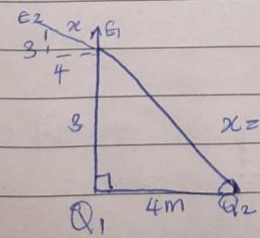


$E_1 = \frac{kQ_1}{r^2} = \frac{9\times10^9 \times 8\times10^{-9}}{7^2} = 1.469N/c$
$\simeq 1.5N/c$

$E_2 = \frac{kQ_2}{r^2} = \frac{9\times10^9 \times 12\times10^{-9}}{7^2} = 12N/c$

$E_{net} = E_1 + E_2 = 1.5 + 12N/c = 13.5N/c$

(ii) E at Point Q on the y axis at $y = 3m$ due to charge.



$C^2 = a^2 + b^2 = C^2 = 4^2 + 3^2$
$C^2 = \sqrt{25} = C = \sqrt{5}$

$E_1 = \frac{kQ_1}{r^2} = \frac{9\times10^9 \times 8\times10^{-9}}{3^2}$ $E_1 = 8N/c$

$E_2 = \frac{kQ_2}{r^2} = \frac{9\times10^9 \times 12\times10^{-9}}{5^2} = 4.32N/c$

20 YEARS OF ACCOMPLISHMENT

Memo

Vector	angle	x-comp	y-comp
$E_1 = 8N/C$	$90°$	$0N/C$	$8N/C$
$E_2 = 432$	$36.87°$	$-3.45N/C$	$2.59N/C$
		$\Sigma x = -3.45N/C$	$\Sigma_{fy} = 10.59N/C$

$E_{net} = \sqrt{E_{fx}^2 + E_{fy}^2}$

$E_{net} = 11.12N/C$

(3) Formulation of indentrés of charge.

a) Volume charge density $\rho = \frac{dQ}{dv} = dQ = \rho dv$.

aii) Surface charge density $\sigma = dQ/dA = dQ = \sigma dA$

aiii) linear charge density $\lambda = \frac{dQ}{dL} = dQ = \lambda dL$.

(b) electric potential difference equation.

$$V_B - V_A = \frac{Q}{4\pi\varepsilon_0}\left[\frac{1}{r_B} - \frac{1}{r_A}\right]$$

where Q = point charge.

r_B = distance of Q to point B

r_A = distance of Q to point A

Due to several point charges.

$$V_p = \frac{1}{4\pi\varepsilon_0}\left[\frac{Q_1}{r} \mp \frac{Q_2}{r_2}\right]$$ where V = electric potential.

Q = point charge

r = distance of Q.

(c) Point charge $Q_1 = 10\mu C$ $Q_2 = -2\mu C$ along x axis $x = 0$, $x = 4m$ find the position along the x-axis where $V = 0$.

Memo

Q_1 4m q_2 $V=0$

$$V_p = k\left[\frac{Q_1}{r_1} + \frac{Q_2}{r_2}\right]$$

$$V_p = 9\times 10^9 \times \left[\frac{10\times 10^{-6}}{4+x} + \frac{-2\times 10^{-6}}{x}\right]$$

$$0 = 9\times 10^9 \times \left[\frac{10\times 10^{-6}}{4+x} + \frac{-2\times 10^{-6}}{x}\right]$$

$$0 = \frac{10\times 10^{-6}}{4+x} + \frac{-2\times 10^{-6}}{x} = \frac{10\times 10^{-6}}{4+x} = \frac{2\times 10^{-6}}{x}$$

$$10\times 10^{-6}x = (4+x)(2\times 10^{-6})$$

$$10\times 10^{-6}x = 8\times 10^{-6} + 2\times 10^{-6}x.$$

$$8\times 10^{-6} = 10\times 10^{-6}x - 2\times 10^{-6}x.$$

$$8\times 10^{-6} = 8\times 10^{-6}x$$

$$x = \frac{8\times 10^{-6}}{8\times 10^{-6}} = 1$$

Position along the x-axis is 1m.

where $V=0$.

$$V = k\left[\frac{Q_1}{r_1} + \frac{Q_2}{r_2}\right]$$

$$0 = \left[\frac{10\times 10^{-6}}{4-x} + \frac{-2\times 10^{-6}}{x}\right]$$

$$\frac{2\times 10^{-6}}{x} = \frac{10\times 10^{-6}}{4-x}$$

Memo

$[4-x][2\times10^{-6}] = 10\times10^{-6}x$.

$8\times10^{-6} - 2\times10^{-6}x = 10\times10^{-6}x$.

$8\times10^{-6} = 10\times10^{-6}x + 2\times10^{-6}x$.

$8\times10^{-6} = 12\times10^{-6}x$.

$x = \dfrac{8\times10^{-6}}{12\times10^{-6}}$ $\quad x = 0.67m$.

Position of $V = 0$ is $0.67m$.

(4a) Magnetic flux is defined as the strenght of the magnetic field which can be represented by line of forces. It is donated as ϕ.

$\phi = B \cdot dA$

(4b) $M_e = 9.11\times10^{-31}kg$, $r = 1.4\times10^{-7}m$; $B = 3.5\times10^{-1}\,w/m^2$

Cyclotron frequency = angular Speed . $q = 1.6\times10^{-19}$

$F_B = qvB = \dfrac{M_eV^2}{r}$

$M_eV = qBr$

$V = \dfrac{qBr}{M_e} = \dfrac{1.6\times10^{-19}\times3.5\times10^{-1}\times1.4\times10^{-7}}{9.11\times10^{-31}}$

$V = 8.61\times10^{-3}\,m/s$

$\omega = \dfrac{V}{r} = \dfrac{qB}{M_e} = \dfrac{1.6\times10^{-19}\times3.6\times10^{-1}}{9.11\times10^{-31}}$

$\omega = 6.14\times10^{10}s^{-1}$

(4c) Mass of electron = $9.11\times10^{-31}kg$

Memo

radius $= 1.4 \times 10^{-7}$ m $\qquad B = 3.5 \times 10^{-1}$ w/m^2

and we were asked to find the Cycloton frequency which is the same thing as angular Speed. It is Called Cycloton frequency because. It is a frequency of an accelator Called Cyclotron.

Recall ω = angular Speed -

$\omega = \frac{qB}{m}$. Since Cyclotron frequency = angular Speed.

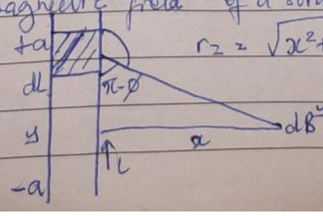
The Cyclotron frequency $= 6.14 \times 10^{-10} s^{-1}$ having a Unit of $\frac{1}{T}$ which is the Unit of frequency dimensionally.

(5a) Bio-Savart law states that the magnetic field is directly Proportional to the product permability of free Space (μ) the Current (I), the Change in lenght, the radius - and Inversely proportional to Square of radius (r^2). Mathematically:

$$d\hat{B} = \frac{\mu_0 I d\vec{l} \times \hat{r}}{4\pi r^2}$$

where μ_0 {permeability of free Space} $= 4\pi \times 10^{-7}$ T·m/A;
r = radius. $\qquad I$ = steady Current
dB = magnetic field $\qquad dL$ = lenght of wire Unit is w/m^2

(5b) Magnetic field of a straight current Carrying Conductor



$r = \sqrt{x^2+y^2}$ $\quad$ A Section of a straight current Carrying Conductor.

20 YEARS
OF ACCOMPLISHMENT

Memo

Applying Bio - Savart law, we find Magnitude of the field

$$B = \frac{\mu_0 I}{4\pi} \int_{-a}^{a} \frac{dl \sin \phi}{r^2}$$

$\sin(\pi - \phi) = \sin\theta$

$$B = \frac{\mu_0 I}{4\pi} \int_{-a}^{a} \frac{dl \sin(\pi - \phi)}{r^2}$$

from the diagram $r^2 = x^2 + y^2$

$$B = \frac{\mu_0 I}{4\pi} \int_{-a}^{a} \frac{dl \sin(\pi - \phi)}{x^2 + y^2} \quad ----(I)$$

But $\sin(\pi - \phi) = \frac{x}{\sqrt{x^2+y^2}} = \frac{x}{(x^2+y^2)^{1/2}} \quad ----(II)$

Substitute (II) into (I)

$$B = \frac{\mu_0 I}{4\pi} \int_{-a}^{a} dl \frac{x}{(x^2+y^2)(x^2+y^2)^{1/2}}$$

$$B = \frac{\mu_0 I}{4\pi} \int_{-a}^{a} \frac{dl \; x}{(x^2+y^2)^{3/2}} dy \quad \leftarrow + 1 \rightarrow (III)$$

$dl = dy$; $B = \frac{\mu_0 I x}{4\pi} \int_{-a}^{a} \frac{1}{(x^2+y^2)^{3/2}} \quad ---(III)$

$$\int \frac{dy}{(x^2+y^2)^{3/2}} = \frac{1}{x^2} \frac{y}{(x^2+y^2)^{1/2}}$$

$$B = \frac{M_0 I}{4\pi x} \left[\frac{2a}{(x^2+a^2)^{1/2}} \right] ; \; (x^2+a^2)^{1/2} = a = \infty$$

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

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