011192118 A 7-10-2021

Tawhidul Islam Phy-105

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Ans to the qsn NO: 3

(a)

The cross-Sectional area of the wire is $A = \pi r^2$

$i = 0.50\ A$

$J = 440 \times 10^4\ A/m^2$

$$J = \frac{i}{A}$$

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

$$\therefore r = \sqrt{\frac{i}{\pi J}} = \sqrt{\frac{0.50}{\pi (440 \times 10^4)}}$$

$$= 1.9 \times 10^{-4}\ m$$

The diameter of the wire is therefore, $d = 2r$

$$= (2 \times 1.9 \times 10^{-4})$$

$$= 3.8 \times 10^{-4}\ m$$

Ans

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Qsn 2
(a)

$E = 18\ NC^{-1}$

$r = 5cm = 0.05m$

Now,

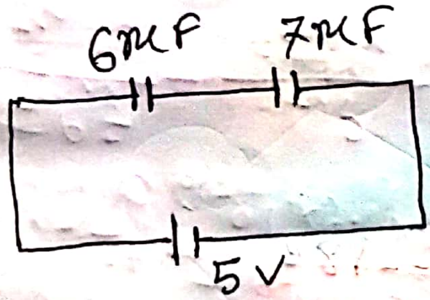
$$E = \frac{kq_1}{r^2}$$

$$q_1 = \frac{Er^2}{k} = \frac{18 \times (0.05)^2}{9 \times 10^9}$$

$$= 5 \times 10^{-12}$$

The value of positive charge is
$+5 \times 10^{-12}\ C$ Ans

Qsn 2
(b)



$$E = \frac{1}{2}cv^2 = \frac{1}{2} \times (5)^2 \times \left(\frac{6 \times 7}{6+7}\right) \times 10^{-6}$$

$$= 4.04 \times 10^{-5}\ J$$

$Q = VC$

$= 5 \times \frac{6 \times 7}{6+7} \times 10^{-6}$

$= 1.62 \times 10^{-5}$ C

Ans.

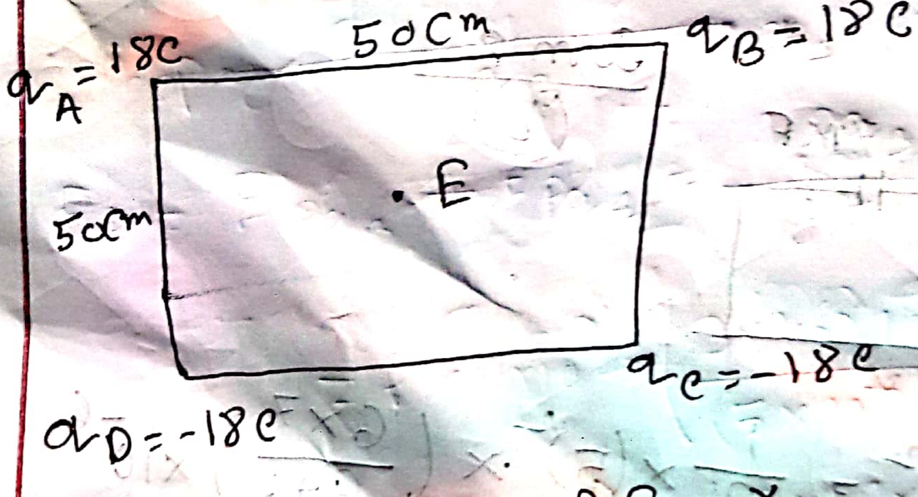
Qsn 2
(c)

$A = 18$ C

$B = 18$ C

$C = -18$ C

$D = -18$ C



$AE = BE = CE = DE = x$

$x = \frac{1}{2} BD = \frac{1}{2} \sqrt{(50)^2 + (50)^2}$

$$V = V_A + V_B + V_C + V_D$$

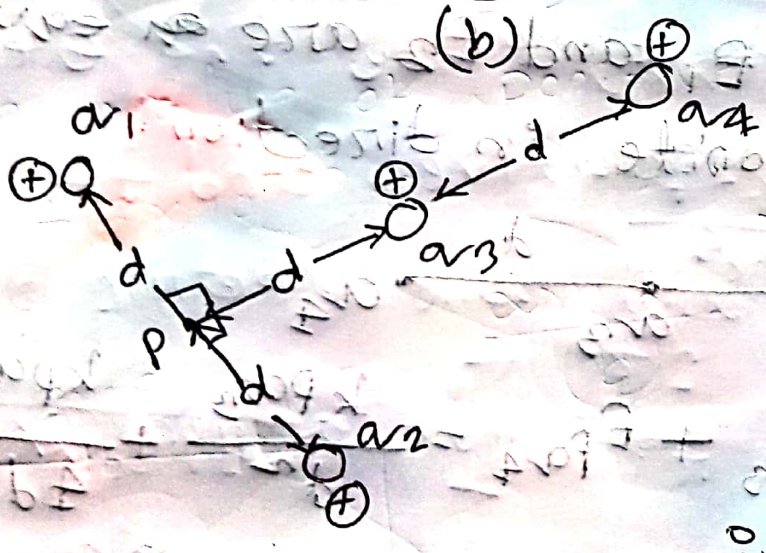
$$= \frac{kq_A}{r_A} + \frac{kq_B}{r_b} + \frac{kq_C}{r_c} + \frac{kq_D}{r_d}$$

$$= \frac{k}{r}(18+18-18-18)$$

$$= 0 \quad \text{Ans}$$

Ans. 3

(b)



due to q_1 and q_2 are in same in magnitude in opposite in direction so that ~~their~~ effect on point p will be ~~connecter~~ cancelout

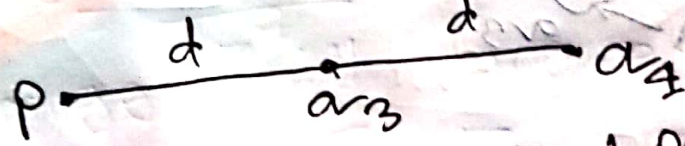
$d = 5 \times 10^{-16}\ m$

$q_1 = +5e = q_2$

$q_3 = +3e$

$q_4 = -12e$

As $q_1 = q_2$ and $d_1 = d_2 = d$ so $E_1 = E_2$ the net electric field at p due to q_1 and q_2 is zero because E_1 and E_2 are equal and opposite in direction



$$E_p = E_{pq_3} + E_{pq_4} = \frac{kpq_3}{d^2} + \frac{kpq_4}{4d^2}$$

$$= P \times 9 \times 10^9 \times \left(\frac{3 \times 1.6 \times 10^{-19}}{(5 \times 10^{-6})^2} + \frac{-12 \times 1.6 \times 10^{-19}}{4 \times (5 \times 10^{-6})^2} \right)$$

$$= P \times 9 \times 10^9 \times \left(\frac{3 \times 1.6 \times 10^{-7}}{25} - \frac{12 \times 1.6 \times 10^{-7}}{100} \right)$$

$= 0$

An

Ans 1

(a)

(i)

we know that if we have a single positively charged particle, a positively charged particle will be pushed away from it by the electric force. The electric field is a force field around a charged object that illustrates the direction the electric force the push an imaginary positively charged particle if there was on there. if we have a sphere that is negative charged. The electric field would show that an imaginary positively charge particle is pulled towards the sphere by the electric force.

Ans 1

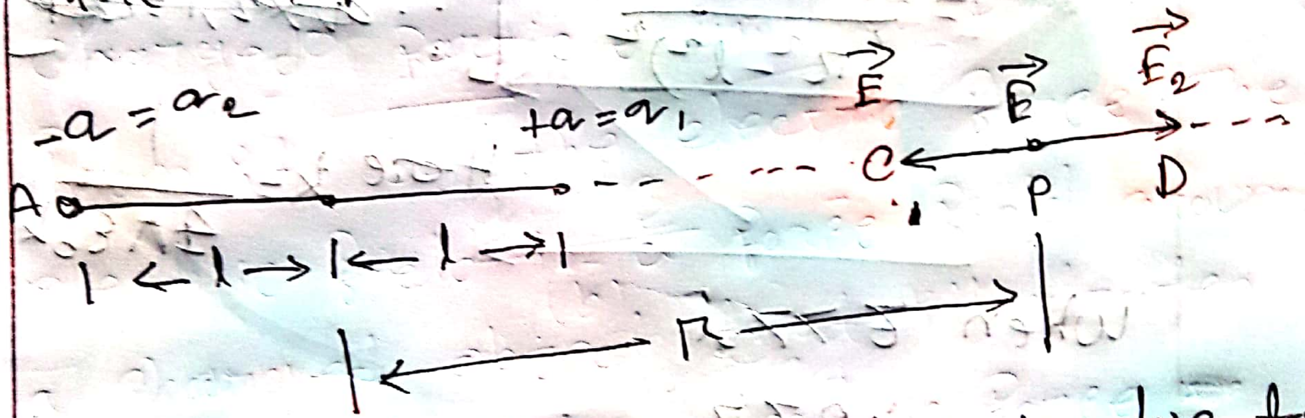
(a)

(ii)

A positive charged, if free to move in an electric field, will move from a high potential point to a low potential point. Again note that the work done by the electric field is positive, and the negative charge will lose electric potential energy and again kinetic energy as it moves against the field.

Ans to the ans No: 4

Derive expression for electric field due to a dipole. Modify the expression when $z >> d$.



Electric field at point P in due to charge $q_1 = q$ and $q_2 = -q$.

Total Electric field $E = E_1 + E_2$

$$= \frac{kq_1}{d_1^2} + \frac{kq_2}{d_2^2}$$

$$= \frac{kq}{(r-l)^2} + \frac{-kq}{(r+l)^2}$$

$$= kq \left\{ \frac{1}{(r-l)^2} - \frac{1}{(r+l)^2} \right\}$$

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$$= kq \frac{(r+l)^2 - (r-l)^2}{(r^2-l^2)^2}$$

$$= kq \frac{4rl}{(r^2-l^2)^2}$$

$q \times 2l = \varepsilon$

$$= \frac{k \, 2 \varepsilon r}{(r^2-l^2)^2} \left[\because \cancel{q \times 2l = \varepsilon} \right]$$

Here $k = \frac{1}{4\pi\varepsilon_0 k}$

When $\varepsilon >> l$,

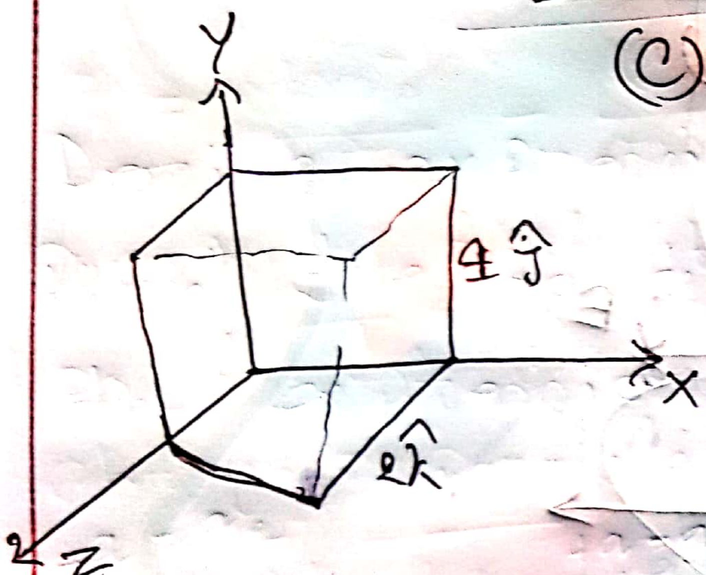
$$E = \frac{k \, 2 \varepsilon r}{r^4}$$

$$= k \frac{2\varepsilon}{r^3} \left[k = \frac{1}{4\pi\varepsilon_0 k} \right]$$

— o —

Ans 3

(C)



$\vec{E} = 4\hat{j} + 2\hat{k}$

$\vec{E}_x = 0\hat{i}$ 50 cm = 0.5 m

$\vec{E}_y = 4\hat{j}$

$E_z = 2\hat{k}$

$ds = (0.5 \times 0.5)\,m^2$ for all planes.

$\phi_{xy} = E_z \times dS = 2 \times (0.5 \times 0.5)$

$= 0.5\ Nm^2C^{-1}$

$\phi_{yz} = E_x \times dS = 0 \times (0.5 \times 0.5) = 0\ Nm^2C^{-1}$

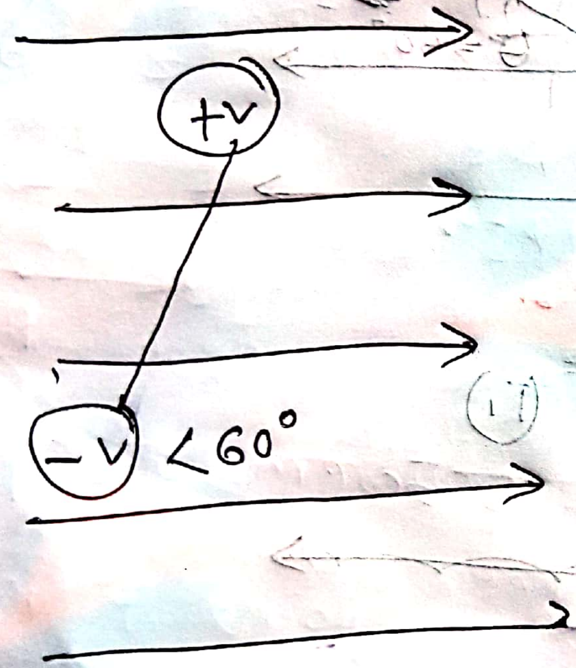
$\phi_{zx} = E_y \times dS = 4 \times (0.5 \times 0.5) = 1\ Nm^2C^{-1}$

Ans

Qn 1

(b)

(i)



(ii)

$$\vec{\tau} = \vec{P} \times \vec{E}$$

$$\tau = PE\sin\theta$$

$$= PE\sin 60^\circ$$

$$= \frac{\sqrt{3}PE}{2}$$