QUIZ 1

PHY 112

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sec : 08

Ans to the qr no 4 Q 1

Given, $q_1 = -45 \times 10^{-9}\ C$

$q_2 = 39 \times 10^{-9}\ C$

$q_3 = 40 \times 10^{-9}\ C$

Part I

a

$$\vec{r}_3 = -6\hat{i} - 16\hat{j}$$

$$\vec{r}_{P_2} = -7\hat{i} - 9\hat{j}$$

$$\vec{r}_{3,P_2} = \vec{r}_{P_2} - \vec{r}_3$$

$$= -7\hat{i} - 9\hat{j} - (-6\hat{i} - 16\hat{j})$$

$$= -7\hat{i} + 6\hat{i} - 9\hat{j} + 16\hat{j}$$

$$= -\hat{i} + 7\hat{j}$$

$$= -1 \times 10^{-2}\,\hat{i} + 7 \times 10^{-2}\,\hat{j}$$

$$= -0.01\,\hat{i} + 0.07\,\hat{j}$$

x component = 0.01 m

y component = 0.07 m

b

$$\vec{r}_{3,P_2} = -0.01\,\hat{i} + 0.07\,\hat{j}$$

$$|\vec{r}_{3,P_2}| = \sqrt{(-0.01)^2 + (0.07)^2}$$

$$= 0.07$$

$$\vec{E}_3(P_2) = \frac{k\,q_3}{(r_{3,P_2})^3} \cdot \vec{r}_{3,P_2}$$

$$= \frac{8.987 \times 10^9 \times (40 \times 10^{-9})}{(0.07)^3} \cdot \vec{r}_{3,P_2}$$

$$= \frac{359.48}{(0.07)^3} \cdot \vec{r}_{3,P_2}$$

$$= 1048046.647 \cdot \vec{r}_{3,P_2}$$

$$\vec{E}_{3(P_2)} = 1048046.647\,(-0.01\,\hat{i} + 0.07\,\hat{j})$$

$$= -10480.46\,\hat{i} + 73363.26\,\hat{j}$$

Part II

c

Given,

$$\vec{E}_{\text{or}_1(P_2)} = -54765\,\hat{i} + 0\,\hat{j}$$

$$\vec{E}_{\text{or}_2,(P_2)} = -49567\,\hat{i} - 49567\,\hat{j}$$

$$\vec{E}_{\text{or}_3(P_2)} = -10480.46\,\hat{i} + 73363.26\,\hat{j}$$

$$\vec{E}_{\text{net}} = \vec{E}_{\text{or}_1(P_2)} + \vec{E}_{\text{or}_2(P_2)} + \vec{E}_{\text{or}_3(P_2)}$$

$$\vec{E}_{net} = (-54765 - 49567 - 10480)\,\hat{i} + (-49567 + 73363.26)\,\hat{j}$$

$$= -114812\,\hat{i} + 23796\,\hat{j}$$

(d)

$$\vec{E}_{net}(P_2) = -114812\,\hat{i} + 23796\,\hat{j}$$

charge at P_2, $q_4 = 2.5 \times 10^{-9}$ C

$$\therefore |\vec{E}_{net}| = \frac{\vec{F}_{net}}{q_4}$$

$$\Rightarrow |\vec{F}_{net}| = |(-114812\,\hat{i} + 23796\,\hat{j})|$$

$$\Rightarrow |\vec{F}_{net}| = |q_4 \vec{E}_{net}|$$

Now, $q_4 \vec{E}_{net} = (-114812\,\hat{i} + 23796\,\hat{j})(25 \times 10^{-9})$

$= -2.87 \times 10^{-3}\,\hat{i} + 5.949 \times 10^{-4}\,\hat{j}$

$|F_{net}| = |q_4 \vec{E}_{net}| = \sqrt{(-2.87 \times 10^{-3})^2 + (5.949 \times 10^{-4})^2}$

$= 2.93 \times 10^{-3}$

$\therefore |\vec{F}_{net}| = 2.93 \times 10^{-3}\ N$