Section 2

Physics(II)

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Complete:

The charging of an object t can be done by:

a) Friction **b) Conduction** **c) Induction**

MCQ:

Two particles, X and Y, are 4 m apart. X has a charge of $2Q$ and Y has a charge of Q. The force of X on Y:

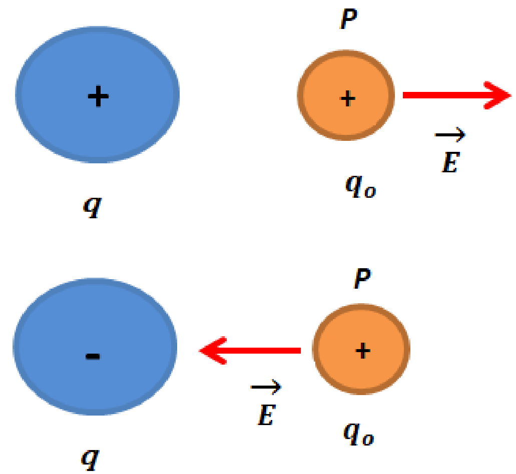
A. has twice the magnitude of the force of Y on X
B. has half the magnitude of the force of Y on X
C. has four times the magnitude of the force of Y on X
D. has one-fourth the magnitude of the force of Y on X
E. has the same magnitude as the force of Y on X

Ans: E

Electric Field

The vector of electric field at point *P*:

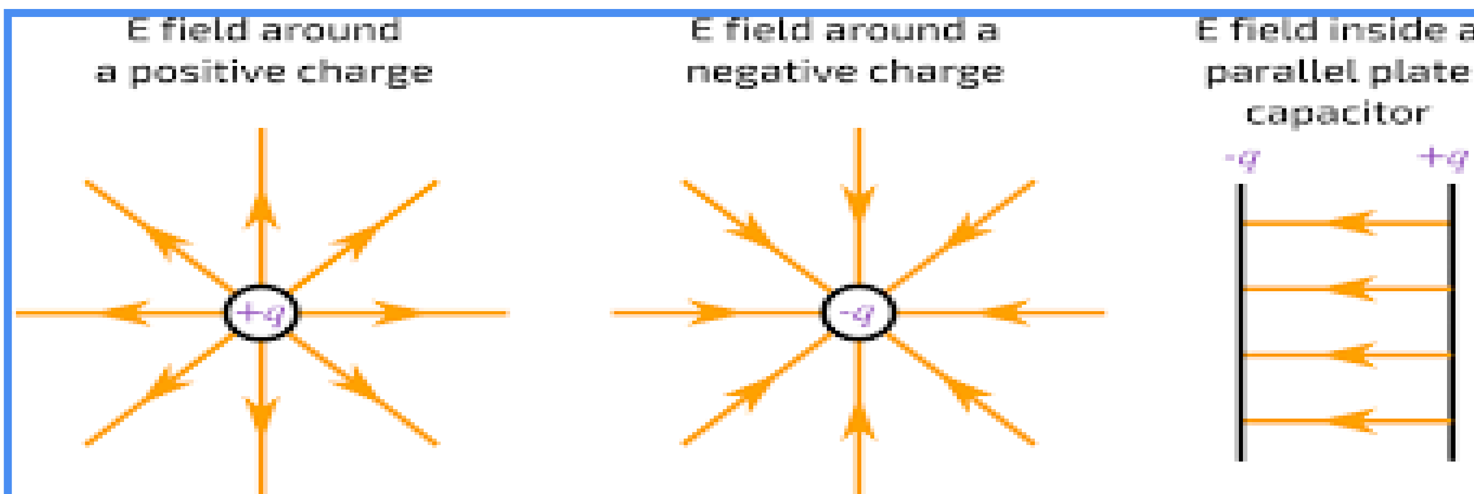
$$\boxed{\vec{E} = \frac{\overrightarrow{F_e}}{q_o}}$$



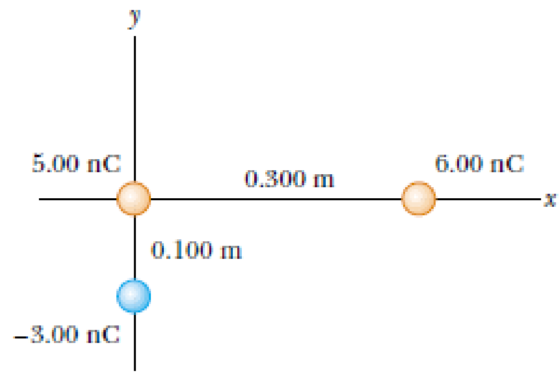
$$\overrightarrow{F_e} = k_e \frac{|q||q_o|}{r^2}\,\hat{r}$$

$$\boxed{\vec{E} = k_e \frac{|q|}{r^2}\,\hat{r}}$$

q_o: is a positive test charge.
q: is the source charge (the charge which produces the electric field).



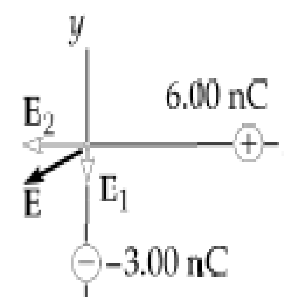
1) Three point charges are arranged as shown in the figure.
(a) Find the vector electric field that the 6.00 nC and -3.00 nC charges together create at the origin.
(b) Find the vector force on the 5.00 nC charge.



(a) $$\mathbf{E}_1 = \frac{k_e|q_1|}{r_1^2}\left(-\hat{\mathbf{j}}\right) = \frac{\left(8.99\times10^9\right)\left(3.00\times10^{-9}\right)}{(0.100)^2}\left(-\hat{\mathbf{j}}\right) = -\left(2.70\times10^3\ \text{N/C}\right)\hat{\mathbf{j}}$$

$$\mathbf{E}_2 = \frac{k_e|q_2|}{r_2^2}\left(-\hat{\mathbf{i}}\right) = \frac{\left(8.99\times10^9\right)\left(6.00\times10^{-9}\right)}{(0.300)^2}\left(-\hat{\mathbf{i}}\right) = -\left(5.99\times10^2\ \text{N/C}\right)\hat{\mathbf{i}}$$

$$\mathbf{E} = \mathbf{E}_2 + \mathbf{E}_1 = \boxed{-\left(5.99\times10^2\ \text{N/C}\right)\hat{\mathbf{i}} - \left(2.70\times10^3\ \text{N/C}\right)\hat{\mathbf{j}}}$$



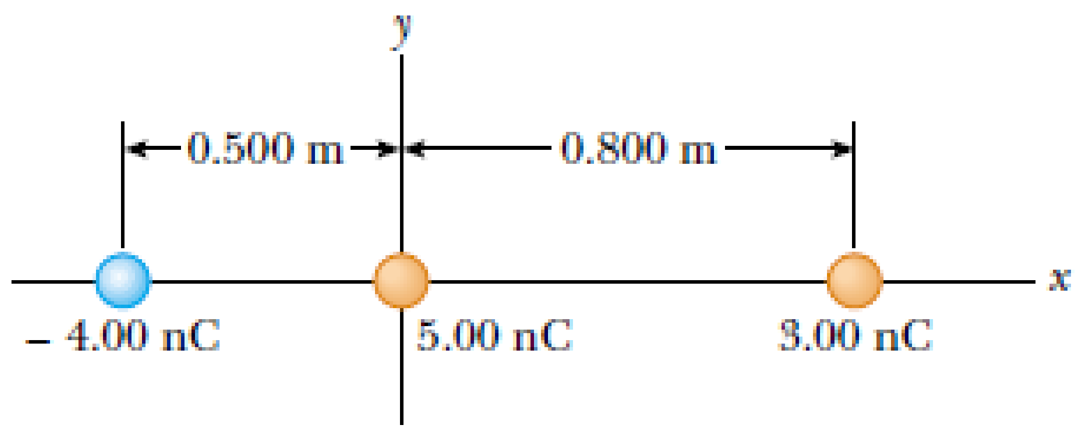
(b) $$\mathbf{F} = q\mathbf{E} = \left(5.00\times10^{-9}\ \text{C}\right)\left(-599\hat{\mathbf{i}} - 2\,700\hat{\mathbf{j}}\right)\ \text{N/C}$$

$$\mathbf{F} = \left(-3.00\times10^{-6}\hat{\mathbf{i}} - 13.5\times10^{-6}\hat{\mathbf{j}}\right)\text{N} = \boxed{\left(-3.00\hat{\mathbf{i}} - 13.5\hat{\mathbf{j}}\right)\mu\text{N}}$$

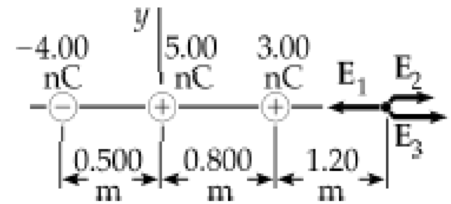
2) Three point charges are aligned along the x axis as shown in the figure. Find the electric field at:

(a) the position(2.00, 0).

(b) the position (0, 2.00).



(a) The field, E_1, due to the 4.00×10^{-9} C charge is in the $-x$ direction.



$$\mathbf{E}_1 = \frac{k_e q}{r^2}\hat{\mathbf{r}} = \frac{\left(8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2\right)\left(-4.00 \times 10^{-9} \text{ C}\right)}{(2.50 \text{ m})^2}\hat{\mathbf{i}}$$

$$= -5.75\hat{\mathbf{i}} \text{ N/C}$$

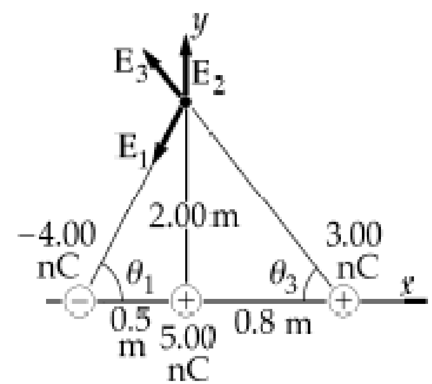
Likewise, E_2 and E_3, due to the 5.00×10^{-9} C charge and the 3.00×10^{-9} C charge are

$$\mathbf{E}_2 = \frac{k_e q}{r^2}\hat{\mathbf{r}} = \frac{\left(8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2\right)\left(5.00 \times 10^{-9} \text{ C}\right)}{(2.00 \text{ m})^2}\hat{\mathbf{i}} = 11.2 \text{ N/C } \hat{\mathbf{i}}$$

$$\mathbf{E}_3 = \frac{\left(8.99 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2\right)\left(3.00 \times 10^{-9} \text{ C}\right)}{(1.20 \text{ m})^2}\hat{\mathbf{i}} = 18.7 \text{ N/C } \hat{\mathbf{i}}$$

$$\mathbf{E}_R = \mathbf{E}_1 + \mathbf{E}_2 + \mathbf{E}_3 = \boxed{24.2 \text{ N/C}} \text{ in } +x \text{ direction.}$$

(b)



$$\mathbf{E}_1 = \frac{k_e q}{r^2}\hat{\mathbf{r}} = (-8.46 \text{ N/C})\left(0.243\hat{\mathbf{i}} + 0.970\hat{\mathbf{j}}\right)$$

$$\mathbf{E}_2 = \frac{k_e q}{r^2}\hat{\mathbf{r}} = (11.2 \text{ N/C})\left(+\hat{\mathbf{j}}\right)$$

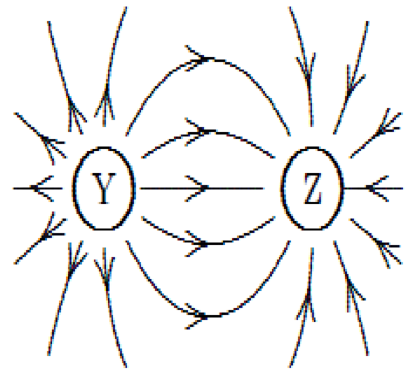
$$\mathbf{E}_3 = \frac{k_e q}{r^2}\hat{\mathbf{r}} = (5.81 \text{ N/C})\left(-0.371\hat{\mathbf{i}} + 0.928\hat{\mathbf{j}}\right)$$

$$E_x = E_{1x} + E_{3x} = -4.21\hat{\mathbf{i}} \text{ N/C} \qquad E_y = E_{1y} + E_{2y} + E_{3y} = 8.43\hat{\mathbf{j}} \text{ N/C}$$

$$E_R = \boxed{9.42 \text{ N/C}} \qquad \theta = \boxed{63.4° \text{ above } -x \text{ axis}}$$

MCQ:

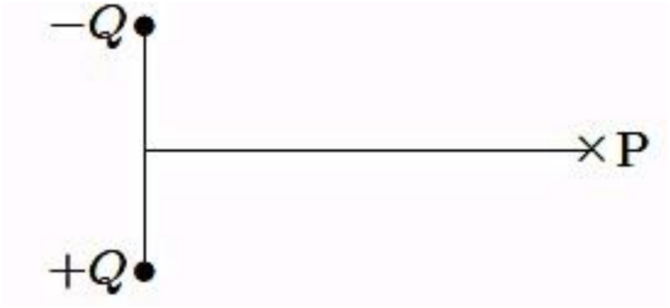
The diagram shows the electric field lines in a region of space containing two small charged spheres (Y and Z). Then:



A. Y is negative and Z is positive
B. the magnitude of the electric field is the same everywhere
C. the electric field is strongest midway between Y and Z
D. Y is positive and Z is negative
E. Y and Z must have the same sign

Ans: D

The diagram shows a particle with positive charge Q and a particle with negative charge −Q. The electric field at point P on the perpendicular bisector of the line joining them is:



A. $\uparrow$
B. $\downarrow$
C. $\rightarrow$
D. $\leftarrow$
E. zero

Ans: A

Thank You