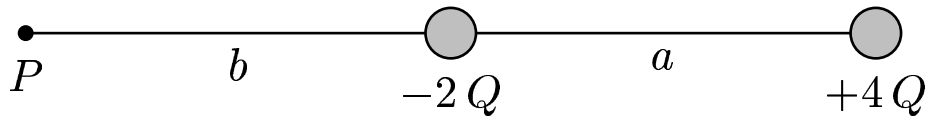


Two point charges are located a distance a apart and lie on the x -axis. Point P is located a distance b from the charge $-2Q$ (the left-most charge).



At P , the direction of the electric field due to the $+4Q$ charge and the $-2Q$ charge are in opposite directions.

Compare the magnitude of the electric fields from the two charges at a point P to the left of the $-2Q$ charge on the x -axes.

- A) Only $E_{+4Q} > E_{-2Q}$ is possible.
- B) Only $E_{+4Q} = E_{-2Q}$ is possible.
- C) Only $E_{+4Q} < E_{-2Q}$ is possible.
- D) All of the above are possible.
- E) None of the above are possible.

Coulomb's law is $\vec{E} = k \frac{Q}{r^2} \hat{r}$.

$$-k \frac{-2Q}{b^2} = k \frac{+4Q}{(a+b)^2}$$

$$\frac{2}{b^2} = \frac{4}{(a+b)^2}$$

$$\frac{a+b}{b} = \sqrt{2}$$

$$b = \frac{a}{\sqrt{2} - 1},$$

therefore if P is closer to $-2Q$, then $\|\vec{E}_{-2Q}\| > \|\vec{E}_{+4Q}\|$ and if P is farther away from $-2Q$, then $\|\vec{E}_{-2Q}\| < \|\vec{E}_{+4Q}\|$.

Consequently, "All of the above are possible".

Answer **D**.

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