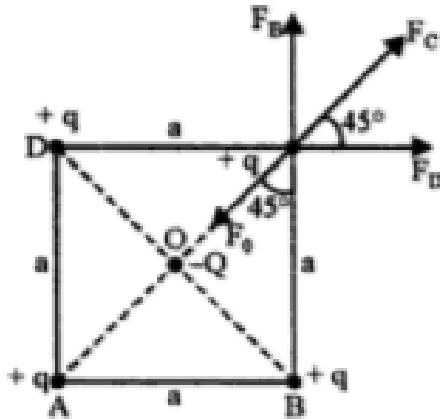


Answer on Question #76057-Physics-Electromagnetism

It is required to hold four equal point charges in equilibrium at the corner of a square. Find the point charge at the center of the square.

Solution

At the corners: q , in the center: $-Q$.



For the equilibrium the net force is zero.

$$F_D + (F_A - F_C) \cos 45 = F \sin 45$$

$$F_B + (F_A - F_C) \sin 45 = F \cos 45$$

$$F = 0$$

$$\frac{kq^2}{a^2} + \left(\frac{kq^2}{(\sqrt{2}a)^2} - \frac{kQq}{\left(\frac{\sqrt{2}}{2}a\right)^2} \right) \frac{\sqrt{2}}{2} = 0$$

$$\frac{kq^2}{a^2} + \left(\frac{kq^2}{2a^2} - \frac{kQq}{\frac{a^2}{2}} \right) \frac{\sqrt{2}}{2} = 0$$

$$q + \left(\frac{q}{2} - 2Q \right) \frac{\sqrt{2}}{2} = 0$$

$$Q = \frac{q}{4} (1 + 2\sqrt{2})$$

The charge will be

$$-Q = -\frac{q}{4} (1 + 2\sqrt{2}).$$

Answer provided by <https://www.AssignmentExpert.com>