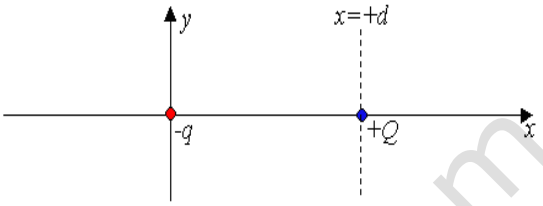
Q- Two charges q = -2 μC and Q = +4μC are placed at a distance d = 12 cm. Find position of a point along the line joining the charges where the electric field is zero.

Let the field is zero at x = x_0. Magnitude of the field at x = x_0 due to the charge at origin will be

$$E_1 = \frac{-q}{4\pi \in_0 (x_0)^2}$$



Field at that point due to charge Q will be

$$E_2 = \frac{Q}{4\pi \in_0 (x_0 - d)^2}$$

Hence the resultant field will be zero if

$$E_1 + E_2 = 0$$

Or $$\frac{-q}{4\pi \in_0 (x_0)^2} + \frac{Q}{4\pi \in_0 (x_0 - d)^2} = 0$$

Or $$\frac{Q}{(x_0 - d)^2} = \frac{q}{x_0^2}$$

Gives $$\frac{(x_0 - d)^2}{x_0^2} = \frac{Q}{q}$$

Or $$\frac{(x_0 - d)}{x_0} = \pm\sqrt{\frac{Q}{q}}$$

Or $$1 - \frac{d}{x_0} = \pm\sqrt{\frac{Q}{q}}$$

Or $$1 - \frac{0.12}{x_0} = \pm\sqrt{2}$$

Or $$1 \pm \sqrt{2} = \frac{0.12}{x_0}$$

Gives $$x_0 = \frac{0.12}{1 \pm \sqrt{2}} =$$ 0.05 m and - 0.29 m

Or x_0 = 5 cm and - 29 cm

As at 5 cm the field due to both charges is in same direction, this is not valid answer and hence the correct answer will be - 29 cm.

x_o = - 29 cm.