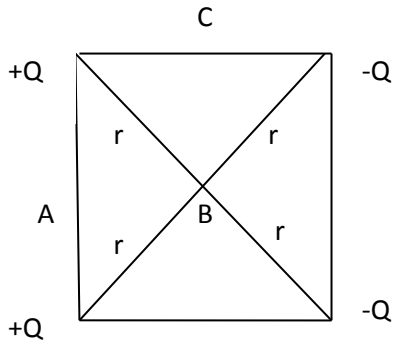
Answer on Question #68037, Physics / Electromagnetism

4 point-charges (same magnitude, signs shown) are arranged in a square. At which one of the "mid-points" (A, B, C) is the net electric field zero?

Solution:



Force on the point at the centre 'B' due to point-charge at +Q (upper) is: $\mathrm{F_{+Qu}} = \mathrm{G}\frac{\mathrm{m^2}}{\mathrm{r^2}}$ (1), where r is +QB

Force on the point at the centre 'B' due to point-charge at –Q (upper) is: $\mathrm{F_{-Qu}} = \mathrm{G}\frac{\mathrm{m^2}}{\mathrm{r^2}}$ (2), where r is -QB

Force on the point at the centre 'B' due to point-charge at -Q (lower) is: $\mathrm{F_{-Ql}} = \mathrm{G}\frac{\mathrm{m^2}}{\mathrm{r^2}}$ (3), where r is -QB

Force on the point at the centre 'B' due to point-charge at +Q (lower) is: $\mathrm{F_{+Ql}} = \mathrm{G}\frac{\mathrm{m^2}}{\mathrm{r^2}}$ (4), where r is +QB

The forces F_{+Qu} and F_{-Ql} are equal and opposite and hence their resultant force: $\mathrm{F_{+Qu}} - \mathrm{F_{-Ql}} = 0$ (5)

The forces F_{+Ql} and F_{-Qu} are equal and opposite and hence their resultant force: $\mathrm{F_{+Ql}} - \mathrm{F_{-Qu}} = 0$ (6)

Of (5) and (6) $\Rightarrow$ the net resultant force acting on the point B at centre is zero.

Answer:

Point B.