ELECTRIC FIELD QUIZ

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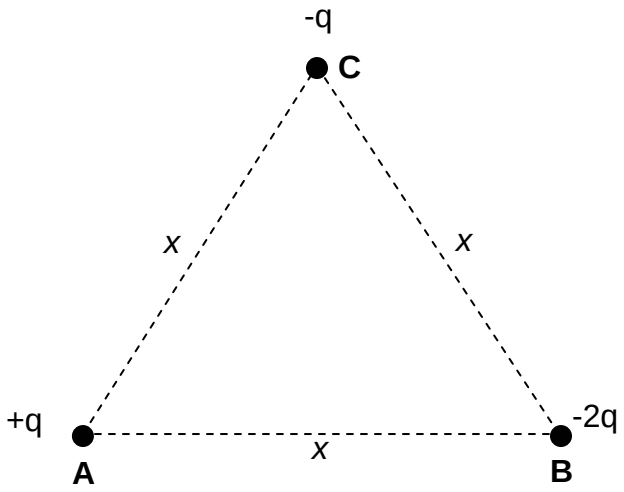

ABC is an equilateral triangle in which AB = CB = AC = *x*.
Charges +q, -2q and –q are placed at A, B and C respectively.

Find the electric potential energy of the whole system.

SOLUTION

Energy needed to bring charge +q from infinity to A = zero

Energy needed to bring charge -2q from infinity to B at a distance *x* from A

$= q_B V_{AB}$

$= -2q \dfrac{q}{4\pi\varepsilon_o x}$

$= \dfrac{-2q^2}{4\pi\varepsilon_o x}$

Energy needed to bring charge -q from infinity to C at a distance *x* from A and B

$= q_C \left(V_{AC} + V_{BC}\right)$

$= -q\left(\dfrac{+q}{4\pi\varepsilon_o x} + \dfrac{-2q}{4\pi\varepsilon_o x}\right)$

$= \dfrac{q^2}{4\pi\varepsilon_o x}$

Total energy $= \dfrac{-2q^2}{4\pi\varepsilon_o x} + \dfrac{q^2}{4\pi\varepsilon_o x} = \dfrac{-q^2}{4\pi\varepsilon_o x}$