ICE: Electric Potential

3) Three charged particles, with charges ± 20 nC and 40 nC, are placed as shown in the figure.

(a) Find the electric potential at the origin, taking V(∞) = 0.

\[ V = \sum \frac{kq_i}{r_i} = \frac{kq_1}{d} + \frac{kq_2}{4.00 \text{ cm}} + \frac{kq_3}{l} \]

Cancel since \( q_1 = -q_2 \)

So \[ V = \frac{kq_3}{l} = \frac{(8.99 \times 10^9 \text{ Nm}^2/\text{C}^2)(4.00 \times 10^{-4} \text{ m})}{1.20 \times 10^{-4} \text{ m}} = 1.20 \times 10^4 \text{ V} \]

(b) Suppose a particle with charge 10 nC is now placed at the origin. What will its kinetic energy be a long time after it is released?

\[ \Delta K + \Delta U = 0 \Rightarrow (K_f - K_i) + (U_f - U_i) = 0 \]

Then \[ K_f = U_i = q_f V = (1.0 \times 10^{-9} \text{ C})(1.20 \times 10^4 \text{ V}) = 1.20 \times 10^{-5} \text{ J} \]