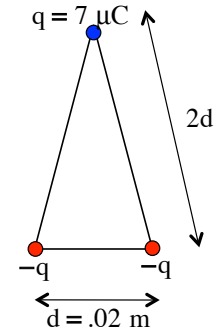
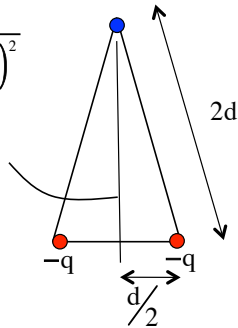


Problem 25.20

Consider the charges shown. What is the electrical potential midway between the two negative charges?:

We need the distances between the charges and the point of interest. The only one that isn't obvious is the one from q above:

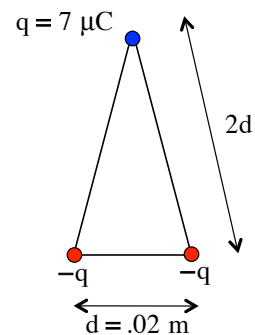
$$\begin{aligned} h &= \sqrt{(2d)^2 - \left(\frac{d}{2}\right)^2} \\ &= \sqrt{3.75d^2} \\ &= 1.936d \end{aligned}$$



1.)

So the electrical potential at the midpoint is:

$$\begin{aligned} V &= k \frac{q_1}{r_1} + k \frac{q_2}{r_2} + k \frac{q_3}{r_3} \\ &= k \left(\frac{q}{1.936d} + k \frac{-q}{\frac{d}{2}} + k \frac{-q}{\frac{d}{2}} \right) \\ &= k \frac{q}{d} \left(\frac{1}{1.936} + \frac{-1}{\frac{1}{2}} + k \frac{-1}{\frac{1}{2}} \right) \\ &= k \frac{q}{d} (.52 - 2 - 2) \\ &= (9 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2) \frac{(7 \times 10^{-6}) \text{ C}}{(.02 \text{ m})} (-3.48) \\ &\Rightarrow V_{.35} = 1.10 \times 10^7 \text{ volts} \end{aligned}$$



2.)