Name_____

Physics 111 Quiz #2, September 15, 2025

Please show all work, thoughts and/or reasoning to receive partial credit. The quiz is worth 10 points total, and all parts may not be of equal weight.

I affirm that I have carried out my academic endeavors with full academic honesty.

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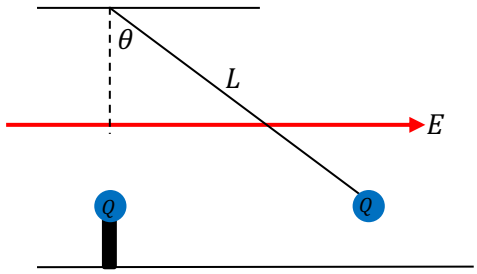
1. Two positive point-charges each with magnitude $Q = 6\mu C$ are shown below. The point-charge on the left is fixed in space and cannot move while the point-charge on the right is attached to a light string of length $L = 65cm$. The string is attached to the ceiling directly above the left point-charge. The right point-charge is in equilibrium when the angle that the string makes with the vertical is $\theta = 50^0$. An external uniform electric field E points from the left to the right everywhere in space with magnitude $2.7 \times 10^5 \frac{N}{C}$. What is the net electric field at the location of the right point-charge attached to the string?



Taking to the right as the positive x-direction (and up the positive y-direction) we have the external field pointing to the right and the electric field from the left point-charge also pointing to the right:

$$E_{net} = E_{pc} + E = \frac{kQ}{r^2} + E$$

$$E_{net} = \frac{9 \times 10^{9\frac{Nm^2}{C^2}} \cdot 6 \times 10^{-6}C}{(0.5m)^2} + 2.7 \times 10^5 \frac{N}{C} = 4.86 \times 10^5 \frac{N}{C}$$

Where, $\sin\theta = \frac{r}{L} \rightarrow r = L\sin\theta = 0.65m \sin 50 = 0.5m$

2. What is the net electric force on the right point-charge attached to the string?

$F_{net} = F_e = qE_{net} = 6 \times 10^{-6}C \cdot 4.9 \times 10^5 \frac{N}{C} = 2.9N$ and the net force points to the right since is Q positive and the net electric field points to the right.

3. What is the magnitude of the tension in the string?

   In the x-direction:

   $$F_e - F_{Tx} = F_e - F_T \sin\theta = ma_y = 0 \rightarrow F_T = \frac{F_e}{\sin\theta} = \frac{2.9N}{\sin 50} = 3.8N$$

4. What is the mass of the right point-charge attached to the string?

   In the x-direction:

   $$F_{Ty} - F_W = F_T \cos\theta - mg = ma_y = 0 \rightarrow m = \frac{F_T \cos\theta}{g} = \frac{3.8N \cos 50}{9.8\frac{m}{s^2}} = 0.25kg$$

5. Suppose that the string is cut. What is the initial horizontal acceleration of the mass?

   When the string is cut, the only horizontal force that remains is F_e, since F_T goes to zero.

   $$F_e = ma_x \rightarrow a_x = \frac{F_e}{m} = \frac{2.9N}{0.25kg} = 11.6\frac{m}{s^2}$$