21.73 A small 12.3 g plastic ball is tied to a very light 28.6 cm string that is attached to a vertical wall of a room. A uniform electric field exists in this room. When the ball has been given an excess charge of $-1.11 \, \mu\text{C}$, you observe that it remains suspended, with the string making an angle of $17.4^\circ$ with the wall. Find the magnitude and the direction of the electric field in the room.
\( \Sigma F_y = 0 \)
\[ T \cos 17.4^\circ - mg = 0 \]
\[ T \cos 17.4^\circ = mg \]

\( \Sigma F_x = 0 \)
\[ F_E = g \frac{E_x}{T} = T \sin 17.4^\circ \]

We need to eliminate \( T \)
\[
\frac{T \sin 17.4^\circ}{T \cos 17.4^\circ} = \frac{g E_x}{mg}
\]
solve for \( E_x \)
\[
E_x = \frac{mg \tan 17.4^\circ}{g} = \frac{(0.0123 \text{ kg})(9.81 \text{ m/s}^2) \tan 17.4^\circ}{(-1.11 \times 10^{-3} \text{ C})}
\]
\[ E_x = -3.41 \times 10^4 \text{ N/C} \]