Physics 6C Fake Midterm

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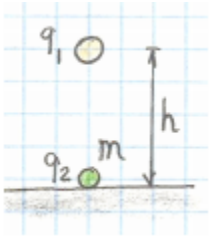
1 Problem 1

A small plastic sphere is charged to $-1\mu C$. It is held at $h = 1cm$ above a small glass bead at rest on a table. The bead has a charge of $+1\mu C$. What is the minimum mass of the bead so that it does not get pulled up to the plastic bead? Assume that the glass bead and the plastic sphere are point charges.

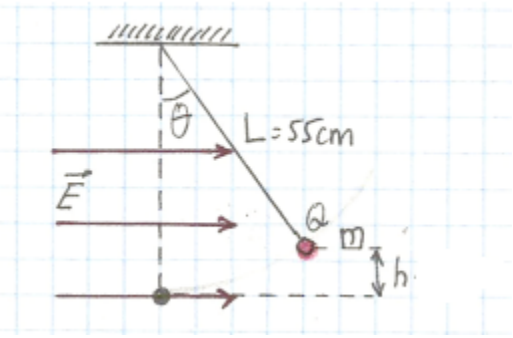


2 Problem 2

An electron is placed into a uniform electric field, $E = 100,000 N/C$ with the initial velocity of $v_0 = 10^3 m/s$ **parallel** to the field. (a) What is the acceleration of the electron? (b) Does it eventually come to rest? If it does, how long does it take? If not, explain why not. (c) If the electric field were now perpendicular to the velocity of the electron (say the electron is traveling in the $+x$ direction and the electric field is in the $+y$ direction), how much does the electron get reflected after being inside field for $t = 2s$.

3 Problem 3

A point charge with the mass $m = 1g$ at the end of an insulating cord of length $55cm$ is observed to be in equilibrium in a uniform horizontal electric field of $15,000 N/C$, when the pendulums bob has $10\mu C$ of charge on it. Find the height h it gets displaced from the lowest position of the pendulum.



4 Problem 4

We have parallel plate capacitor where both plates carry a surface charge density of magnitude of $\sigma = 1\mu C/m^2$ and are separated by a distance $d = 2cm$. (a) What is the electric field inside the capacitor? Draw the electric field in the figure below. (b) If we placed a proton in the center of the capacitor and let it go, what would its velocity be when it hit the negatively charged plate? Draw the electric field and label the forces. Hint: Use energy conservation!