## Physics 10164 - Summer 2019 - Exam \#1A

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work even if you get the right answer. Clearly indicate your answer with a circle or a box and remember to include correct units and significant figures.

1. (35 pts) A -45 nC charge is located at the origin. A +34 nC charge is located at $y=1.3$ meters.
a) Determine the magnitude and direction of the electric field due to these two charges at the coordinates $(x, y)=(1.0,1.3)$.
b) Determine the magnitude and direction of the acceleration felt by a 75 gram particle with charge -19 nC at those same coordinates.
2. ( 35 pts) A 155 gram mass with a charge of $38.0 \mu \mathrm{C}$ is launched directly upward from ground level with an initial speed of $57.0 \mathrm{~m} / \mathrm{s}$. The charge is affected by Earth's usual uniform gravitational field (9.80 N/kg, down) as well as a uniform electric field. Assume only the electric and gravitational forces are significant in this problem.
a) If the mass reaches a maximum height of 222 meters above the ground, what is the magnitude and direction of the electric field?
b) If the voltage at ground level is zero, what is the voltage at the maximum height reached by the mass?
\#3. (30 pts) A $3.2 \mu \mathrm{C}$ charge is fixed in place at the origin. Nearby, at coordinate $x=3.7 \mathrm{~mm}$, a $-5.1 \mu \mathrm{C}$ charged particle with a mass of 240 grams has an initial velocity of $18 \mathrm{~m} / \mathrm{s}$ in the $+x$ direction, which is directly away from the origin.

How far away does the 240 gram mass get from the origin before it is stopped by the electric field of the positive charge at the origin? Assume the electric force is the only relevant force in this problem.

