Physics 10164 - Exam 1C

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. <u>Clearly indicate your answer with a circle or a box</u> and remember to include correct <u>units</u> and <u>significant figures</u>.

#1. (40 pts) A 4.4 μ C charge with a mass of 360 grams is released from rest at a height of 25 meters above the ground. After falling through the usual uniform gravitational field of the Earth (9.8 m/s², down) and a uniform electric field, the mass strikes the ground with a speed of 13 m/s. Assume only the electric and gravitational forces are relevant.

a) What is the magnitude and direction of the uniform electric field through which this mass moves?

b) If the voltage at ground level is zero, what is the voltage at the height from which the mass is dropped?

2. (30 pts) In the triangular arrangement below, find the magnitude and direction of the electric field at point P, which is 1.3 meters away from charge q_B and 1.2 meters away from q_C as shown.

 $q_{\rm A}$ = 44 nC, $q_{\rm B}$ = -18 nC, $q_{\rm C}$ = -28 nC



#3. (30 pts) A parallel-plate capacitor has a cross-sectional area of 3.5 cm^2 and a plate separation of 4.4 mm. It is connected to a 12 Volt battery.

a) What is the charge on the positive plate of the capacitor?

b) What is the magnitude of the electric field between the plates?

c) Keeping the capacitor plates connected to the battery, the plates are pulled apart to a new separation of 6.6 mm. What happens to the charge on the positive plate? Justify your answer qualitatively or mathematically.

d) The capacitor is restored to its original 4.4 mm separation. Now a dielectric with K = 3.0 is inserted between the plates, and the system is allowed time to reach a new equilibrium with the plates still connected to the battery. What is the new charge on the positive plate?

e) What is the new electric field between the plates after they have reached equilibrium with the dielectric inserted?