PHYS 2102

Exam 1

Spring 2004

Dr. Aktas

Name :_____

SS # : _____

You have five questions, 20 points each.

This is a closed book exam. I understand I am not to use any notes or information other than on this exam sheet. I may use a pocket calculator but only for the purpose of numerical calculation. I accept the responsibility to know and observe the requirements of the UNC-Charlotte Code of Student Academic Integrity.

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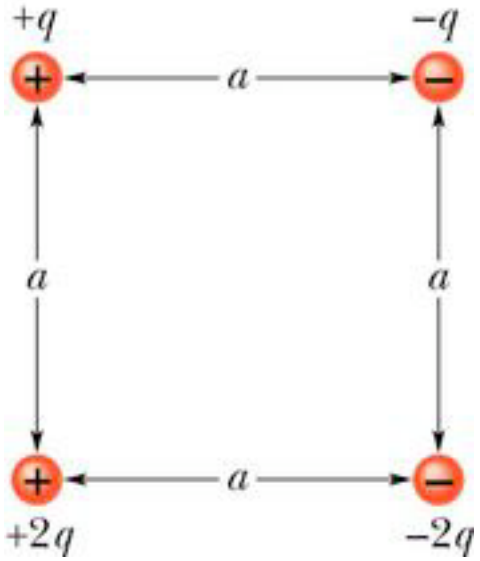
Signature

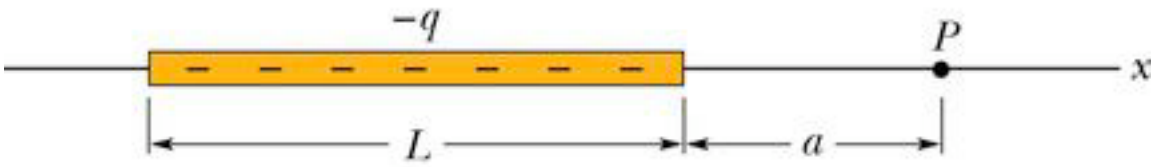
Good luck

Show all of your work. Do not skip steps. First write down the relevant equations then substitute the numbers if necessary.

1. In figure below , what are the (a) horizontal and (b) vertical components of the net electrostatic force on the charged particle in the lower left corner of the square if $q = 1.0 \times 10^{-7}$ C and a = 5.0 cm?



2. In figure below, a nonconducting rod of length L has charge -q uniformly distributed along its length. (a) What is the linear charge density of the rod? (b) What is the electric field at point P, a distance a from the end of the rod? (c) If P were very far from the rod compared to L, the rod would look like a point charge. Show that your answer to (b) reduces to the electric field of a point charge for a >>L.



3. Charge is distributed uniformly throughout the volume of an infinitely long cylinder of radius R. (a) Show that, at a distance r from the cylinder axis (for r < R),

$$E = \frac{\rho r}{2\epsilon_0},$$

where ρ is the volume charge density. (b) Write an expression for E when r > R

4. (a) Show that the electric potential at a point on the central axis of a thin ring of charge of
radius R and a distance z from the ring is

$$V = \frac{1}{4\pi\epsilon_0}\frac{q}{\sqrt{z^2 + R^2}}.$$

(b) From this result, derive an expression for E at points on the ring's axis.

5. In figure below, the battery has a potential difference of 10 V and the five capacitors each have a capacitance of 10 μF. What is the charge on (a) capacitor 1 and (b) capacitor 2?