PHYS 2102

Exam 1

Fall 2003

Dr. Aktas

Name :_____

SS # : _____

You have four questions, 25 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.
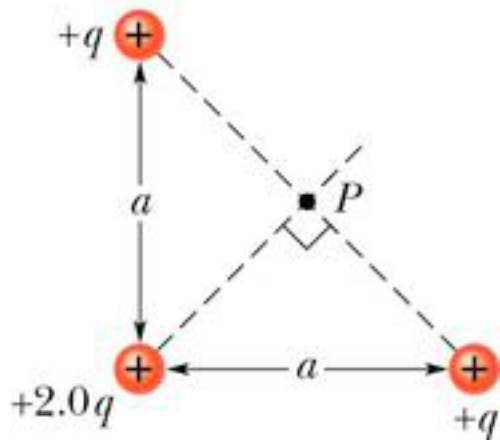
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Signature

Good luck

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

1. Calculate the direction and magnitude of the electric field at point P in Fig. below, due to the three point charges.

2. In Fig. 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.
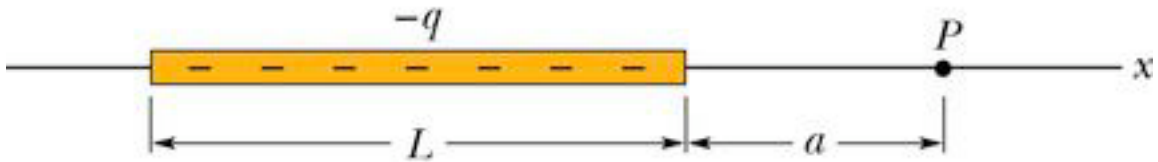
3. In Fig. below a sphere, of radius a and charge +q uniformly distributed throughout its volume, is concentric with a spherical conducting shell of inner radius b and outer radius c. This shell has a net charge of -q. Find expressions for the electric field, as a function of the radius r, (a) within the sphere (r < a), (b) between the sphere and the shell (a < r < b), (c) inside the shell (b < r < c), and (d) outside the shell (r > c). (e) What are the charges on the inner and outer surfaces of the shell?
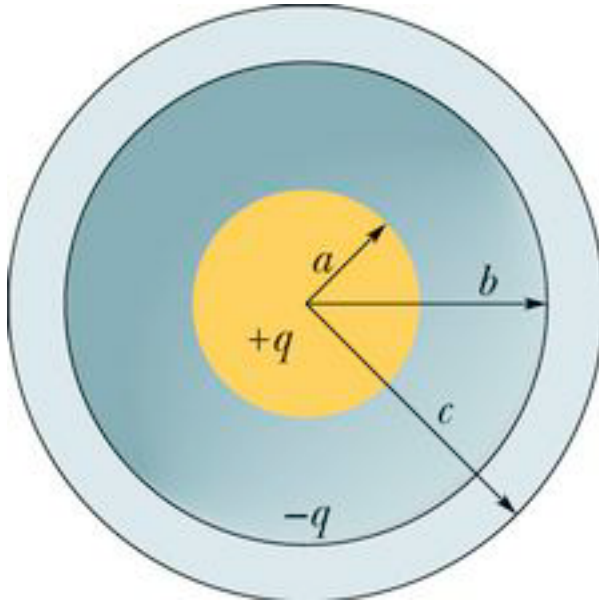
4. (a) Show that the electric potential at a point on the central axis of a thin ring of charge of radius R and a distance z from the ring is

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

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