PHYS 2102

Exam 1

Fall 2006

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.

____

_

Signature

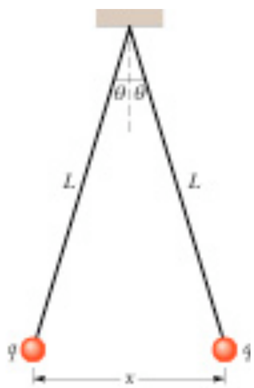
Good luck

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

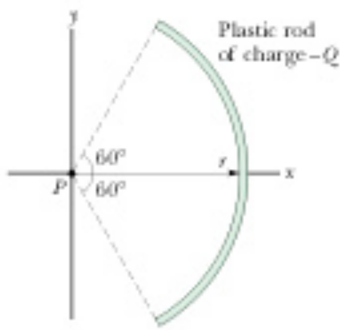
1. Two tiny conducting balls of identical mass m and identical charge q hang from non-conducting threads of length L. Assume θ is so small that one can write $\tan\theta \approx \sin\theta$. Show that for equilibrium,

$$x = \left(\frac{q^2 L}{2\pi\varepsilon_0 mg} \right)^{1/3}$$

Where x is the separation between the balls.

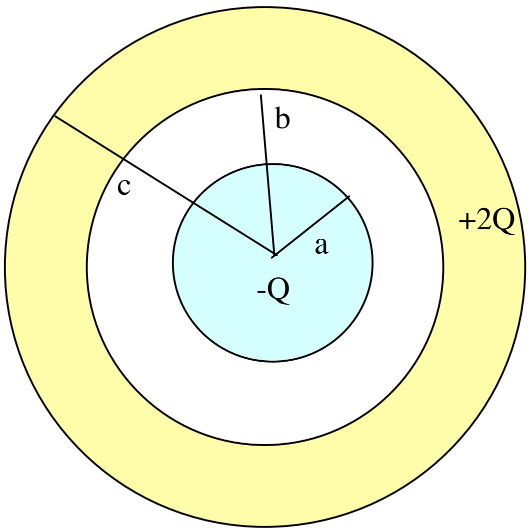


2. Below figure shows a plastic rod having a uniformly distributed charge –Q. The rod has been bent in a 120º circular arc of radius R. In terms of Q and R, what is the electric field $\vec{E}$ due to the rod at point P.

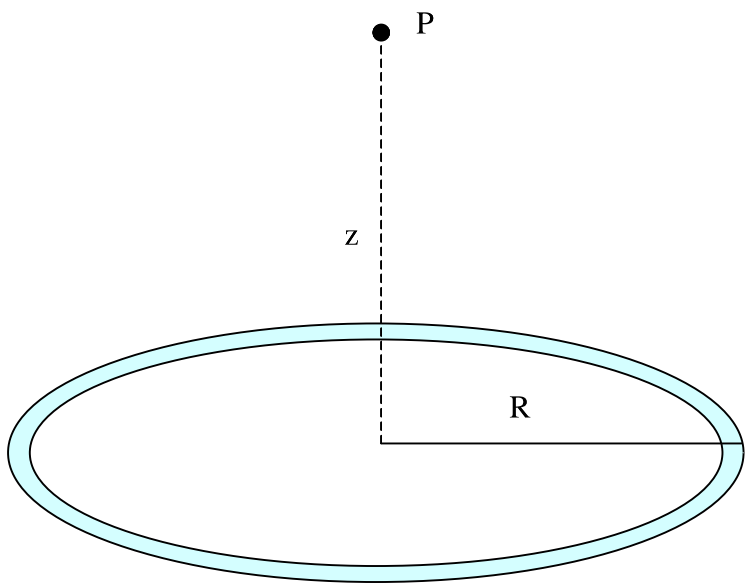


3. A uniformly charged ball of radius a and charge –Q is at the center of a hollow metal shell with inner radius b and outer radius c. The hollow sphere has a net charge of +2Q. Determine the strength of electric field in the four regions:

$r \le a, \quad a < r < b, \quad b \le r \le c, \quad and \quad r > c.$



4. Consider a charged ring with a charge of Q, and radius of R. Calculate its potential along its axis, z distance from the center of the ring at point P, in terms of Q, R and z.



Some useful formulas

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$$

$$\vec{E} = \frac{\vec{F}}{q}, \quad E = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$$

$$\oint_S \vec{E} \bullet d\vec{A} = \frac{q_{enc}}{\varepsilon_0}$$

$$V = \frac{1}{4\pi\varepsilon_0}\frac{q}{r}$$