PHYS 2102-02

Exam 1

Fall 2001

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

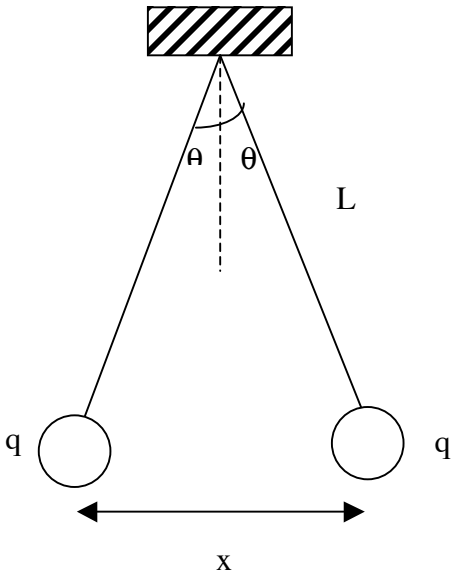
Good luck

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

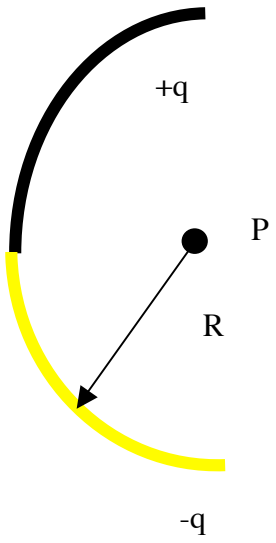
1. In figure below two tiny conducting balls of identical mass m and identical charge θ hang from non-conducting threads of length L. Assume that θ is so small that tan θ can be replaced by its approximate equal, sin θ. Show that, for equilibrium,

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

where x is the separation between the balls.



2. A thin glass rod is bent into a semicircle of radius R. A charge +q is uniformly distributed along the upper half, and a charge –q is uniformly distributed along the lower half as shown below. Find the magnitude and direction of the electric filed E at P, the center of the semi circle.



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),

$$E = \frac{\rho r}{2\varepsilon_0}$$

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

4. The charge q is distributed uniformly throughout a spherical volume of radius R. (a) Setting V=0 at infinity show that the potential at a distance r from the center, where r < R is given by

$$V = \frac{q(3R^2 - r^2)}{8\pi\varepsilon_0 R^3}$$