Name, Surname:	Signature:
Exam Room:	Student ID Number:

PHYS 102 General Physics II – Midterm 1

8 March, 2018 Thursday 19:00 -20:30

Please read!

- Count to make sure that there are 5 pages in the question booklet
- Check your name and surname on front page, and student ID number on each page, and sign each page.
- This examination is conducted with closed books and notes.
- Put all your personal belongings underneath your seat and make sure that pages of books or notebooks are not open.
- Absolutely no talking or exchanging anything (like rulers, erasers) during the exam.
- You must show all your work to get credit; you will not be given any points unless you show the details of your work (this applies even if your final answer is correct!).
- Write neatly and clearly; unreadable answers will not be given any credit.
- If you need more writing space, use the backs of the question pages and put down the appropriate pointer marks.
- Make sure that you include units in your results.
- Make sure that you label the axis and have units in your plots.
- You are not allowed to use calculators during this exam.
- Only the answers in the boxes will be graded and NO partial credit will be given. No points will be given to unjustified answers. Incomplete calculations will not be graded

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1	2	3	4	TOTAL

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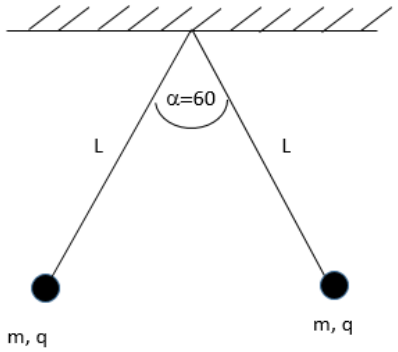
1- (25 pts) Two identical spheres with mass m are hung to the ceiling by light strings of length L as shown in the figure. Each sphere has the same charge q. The radius of the sphere is very small compared to the distance between the spheres. The angle between the strings is 60^0. Calculate the charge of the spheres in terms of m, g, L ,k (g is the gravitational acceleration).



q=

Solution continues on the back side of the page **Yes** □ **No** □

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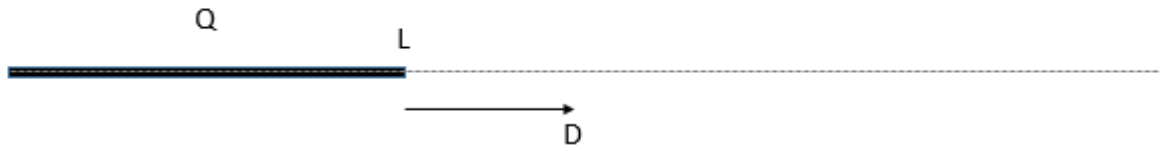
2- (25 pts) As shown in the figure a positive charge Q is uniformly distributed along a thin rod of length L.

a) Calculate the electric field vector produced by a charged rod at a distance D.



E=

b) The second uniformly charged rod is placed on the x axis (see the figure). The second rod also has positive charge Q distributed uniformly. Calculate the magnitude of the electrostatic force applied on the second rod.

F=

Solution continues on the back side of the page **Yes** □ **No** □

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3- (25 pts) A conducting spherical shell with inner radius R_0 and outer radius $2R_0$ has the total charge of +2Q. The second negative point charge –Q is located at its center.

a) Using Gauss's theorem determine and plot the electric-field E for the regions given below as a function of distance (r) from the center.

$r > 2R_o$ $E(r) =$

$R_0 < r < 2R_o$ $E(r) =$

$r < R_0$ $E(r) =$

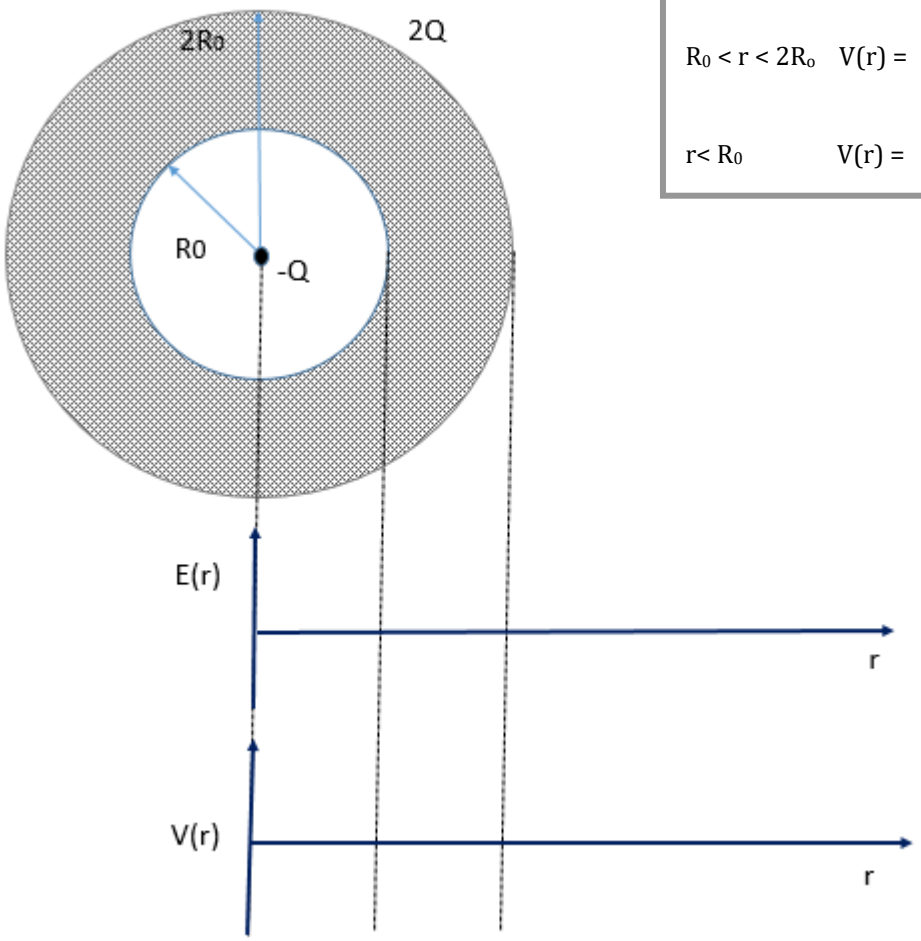
b) Determine and plot the electrical potential V as a function of distance (r) from the center.

$V_{infinity} = 0$

$r > 2R_o$ $V(r) =$

$R_0 < r < 2R_o$ $V(r) =$

$r < R_0$ $V(r) =$



Solution continues on the back side of the page **Yes** □ **No** □

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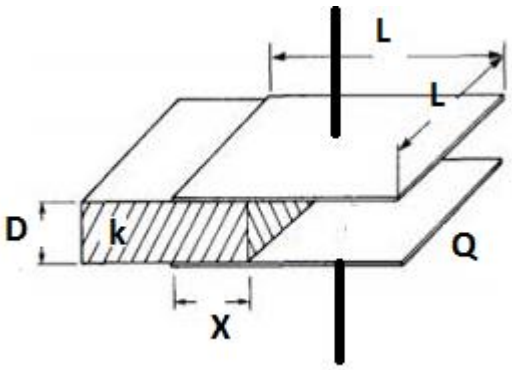
4- (25 pts) Two square conducting plates with sides of length L are separated by a distance D. Initially this capacitor is charged and disconnected from the battery. Suppose that the capacitor is isolated and the total charge in the capacitor is Q_0. A dielectric slap with a constant K with dimensions L x L x D is inserted a distance x into the space between the plates as shown in the figure.



a) Find the total capacitance C of the system

C(x)=

b) Calculate the potential energy stored in the capacitor.

U(x)=

c) Calculate the magnitude of the electrostatic force applied on the dielectric slap.

F(x)=

Solution continues on the back side of the page **Yes** □ **No** □