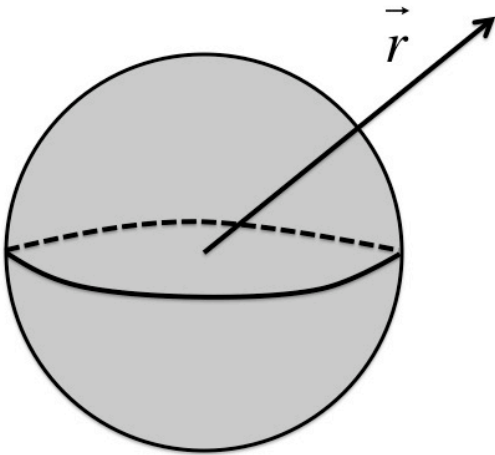


2049H Exam #1

Name:

Problem 1 [44 pts]

Uniformly Charged Solid Sphere (note it is not metallic) has radius R and volume charge density ρ .



Calculate electric field (its dependence on r)

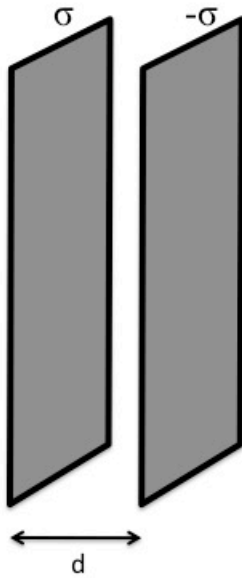
- (a) for outside the sphere [8 pts]
- (b) for inside the sphere [8 pts]

Calculate potential (its dependence on r)

- (c) for outside the sphere [12 pts]
- (d) for inside the sphere [12 pts]

- (e) Does potential vary inside the sphere? [4 pts]

Problem 2 [44 pts]



Parallel plate capacitor is charged to area charge density as depicted. You can assume that the area of the capacitor is A and the distance between capacitor is d .

- (a) What is the electric field between the plates? [4 pts]
- (b) What is the voltage difference between plates? Which plate has the positive voltage? [4 pts]
- (c) What is the force between the plates? [proceed carefully. Ask what is the electric field by one plate first before doing the superposition] [12 pts]
- (d) How much work does it take to move the plate on the left further away from the other plate by distance d ? [12 pts]
- (e) What is the energy stored in the original configuration? You can assume that you need to move the plate from distance 0 to d . Answer in terms of Q ($\sigma \times A$), and C (capacitance) [12 pts]

Problem 3 [True or False Questions] [12pts]

Dielectric strength (maximum electric field) of air is 3×10^6 V/m.

- (a) Given a parallel plate capacitor, maximum charge per unit area you can store depends on the separation between two plates. [3 pts]

- (b) If you have large spherical metallic shell and small spherical shell, you can store more charge on larger shell. [3 pts]

- (c) If you have two capacitors (with equal capacitance) in series, the total capacitance is larger than that of each capacitor. [3 pts]

- (d) Energy of 500 eV is equivalent to an electron being accelerated through a potential difference of 500 volts. It does not matter how the potential is being applied. [3 pts]