

## Homework #3

Due at 6pm on Friday, February 13th, 2015

Reading: Chap 23.

1. Humid air breaks down (its molecules become ionized) in an electric field of  $3.0 \times 10^6$  N/C. In that field, what is the magnitude of the electrostatic force on (a) an electron and (b) an ion with a single electron missing?

2. Density, density, density. (a) A charge  $-100e$  is uniformly distributed along a circular arc of radius 4.00 cm, which subtends an angle of  $40^\circ$ . What is the linear charge density along the arc? (b) A charge  $-100e$  is uniformly distributed over one face of a circular disk of radius 2.00 cm. What is the surface charge density over that face? (c) A charge  $-100e$  is uniformly distributed over the surface of a sphere of radius 2.00 cm. What is the surface charge density over that surface? (d) A charge  $-100e$  is uniformly spread through the volume of a sphere of radius 2.00 cm. What is the volume charge density in that sphere?

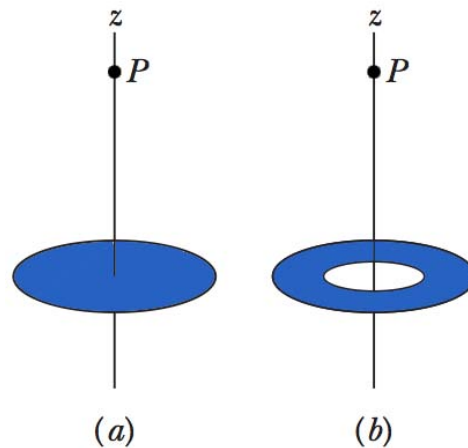
3. HRW Chap 22, P27.

4. HRW Chap 22, P28.

5. HRW Chap 22, P32.

6. HRW Chap 22, P33.

7. Suppose you design an apparatus in which a uniformly charged disk of radius  $R$  is to produce an electric field. The field magnitude is most important along the central perpendicular axis of the disk, at a point  $P$  at distance  $2R$  from the disk [See Figure (a)]. Cost analysis suggests that you switch to a ring of the same outer radius  $R$  but with inner radius  $R/2$  [See Figure (b)]. Assume that the ring will have the same surface charge density as the original disk. If you switch to the ring, by what percentage will you decrease the electric field magnitude at  $P$ ?



8. HRW Chap 22, P51.

9. HRW Chap 22, P53.