Problem 1
Chapter 1, Exercise 3. Two volley balls, mass 0.3 kilogram (kg) each, tethered by nylon strings and charged with an electrostatic generator, hang as shown in the diagram (2.5 m vertical from the tether, 0.5 m horizontal from each other). What is the charge on each in coulombs, assuming the charges are equal? (Reminder: the weight of a 1-kg mass on earth is 9.8 newtons, just as the weight of a 1-gm mass is 980 dynes.)

Problem 2
Chapter 1, Exercise 5. A thin plastic rod bent into a semicircle of radius $R$ has a charge of $Q$, in esu, distributed uniformly over its length. Find the strength of the electric field at the center of the semicircle.

Problem 3
Chapter 1, Exercise 10. At the beginning of the century the idea that the rest mass of the electron might have a purely electrical origin was very attractive, especially when the equivalence of energy and mass was revealed by special relativity. Imagine the electron as a ball of charge, of constant volume density out to some maximum radius $r_0$. Using the result of Problem 1.9 ($U = \frac{3}{2}(Q^2/a)$), set the potential energy of this system equal to $mc^2$ and see what you get for $r_0$. One defect of the model is rather obvious: Nothing is provided to hold the charge together!

Problem 4
Chapter 1, Exercise 11. A charge of 1 esu is at the origin. A charge of $-2$ esu is at $x = 1$ on the $x$ axis.

(a) Find a point on the $x$ axis where the electric field is zero.

(b) Locate, at least approximately, a point on the $y$ axis where the electric field is parallel to the $x$ axis.
   [A calculator should help with (b).]

Problem 5
Chapter 1, Exercise 14. A charge $Q$ is distributed uniformly around a thin ring of radius $b$ which lies in the $xy$ plane with its center at the origin. Locate the point on the positive $z$ axis where the electric field is the strongest.

Problem 6
Chapter 1, Exercise 16. The sphere of radius $a$ was filled with positive charge at uniform density $\rho$. Then a small sphere of radius $a/2$ was carved out, as shown in the figure (the large sphere’s center and top are diametrically opposite each other on the small sphere), and left empty. What are the direction and magnitude of the electric field at $A$ (the center of the large sphere)? At $B$ (the bottom of the large sphere)?
Problem 7
Chapter 1, Exercise 17.

(a) A point charge $q$ is located at the center of a cube of edge length $d$. What is the value of $\int \vec{E} \cdot d\vec{a}$ over one face of the cube?

(b) The charge $q$ is moved to one corner of the cube. What is now the value of the flux of $\vec{E}$ through each of the faces of the cube?

Problem 8
Chapter 1, Exercise 31. Like the charged rubber balloon described on page 31, a charged soap bubble experiences an outward electrical force on every bit of its surface. Given the total charge $Q$ on a bubble of radius $R$, what is the magnitude of the resultant force tending to pull any hemispherical half of the bubble away from the other half? (Should this force divided by $2\pi R$ exceed the surface tension of the soap film interesting behavior might be expected!)

Ans. $Q^2/8R^2$. 