Physics 102– Pledged Problem 5

Time allowed: **2 hours at a single sitting**
Due 5PM Monday, February 26, 2007, in the boxes marked Phys 101-102 in the physics lounge. You may use your own textbook, your notes, and a non-programmed calculator. You may also consult the on-line solutions to the corresponding suggested problems. You should consult no other help. Show how you arrived at your answer; the correct answer by itself may not be sufficient.
Further instructions:
(a) Write legibly on **one** side of 8.5" x 11" white or lightly tinted paper.
(b) Staple all sheets together, including this one, in the upper left corner. Make one vertical fold.
(c) On the outside, print your name in capital letters, your LAST NAME followed by your FIRST NAME.
(d) Below your name, print the phrase "Pledged Problem 5", followed by the due date.
(e) Write and sign the pledge, with the understanding that you may consult the materials noted above.
(f) Indicate your **start time** and **end time**.

I. A solid spherical conductor has radius b. A conducting spherical shell, concentric with the solid sphere, has inner radius c and outer radius d. These two conductors are connected across a battery of potential V_o, with inner conductor connected to the negative terminal and the outer conductor connected to the positive terminal. Express your answers in terms of V_0, b, c, d, and possibly other constants.

(a) Determine the charge on the surface of the inner conductor ($r = b$), and on the inner surface of the outer conductor, at $r = c$.
(b) Determine the electric field between the conducting shells. Be sure to indicate the direction as well as the magnitude.
(c) Determine the capacitance of this configuration and the energy stored in the capacitor.
(d) Determine the total energy stored in the electric field between the conducting shells by integrating the energy density of the electric field over that region. Compare to your result from (c).

II. Three capacitors are connected to form a triangle as shown below.

(a) Determine the capacitance between points a and b.
(b) Determine the capacitance between the points a and c.
(c) If a battery V_o is connected between points a and b, determine the charge on each capacitor and the energy stored in each capacitor.