Physics 4B: Collected Homework 2

1. How much work is required to assemble a sphere of total charge Q with radius R and uniform charge density (charge per unit volume)? Give your answer in terms of Q and R. (Hint: consider the work an external agent must do dW_{app} to bring up a shell of charge of thickness dr just to the outside of a sphere of charge of radius r.)

2. What is the capacitance of a pair of parallel wires of length ℓ and radius r, with a separation distance d (where $d > r$) between their central axes? Assume $\ell \gg r$ and (as we did in class for the cylindrical capacitor example) that you can ignore edge effects around the ends of the wire. You may also assume that the distribution of a charge placed on the wire would be uniform per unit length.

3. Find the equivalent capacitance of the infinite circuit diagrammed below. The circuit consists of the same piece containing two identical capacitors, each with capacitance C, repeated over and over *ad infinitum*.