

ECE 09.303 Fall 2018
Homework 5
Chapter 6/23 - Electrostatic Energy and Capacitors

1.

Four $75\text{-}\mu\text{C}$ charges, initially far apart, are brought onto a line where they're spaced at 5.0-cm intervals. How much work does it take to assemble this charge distribution?

2.

Two closely spaced square conducting plates measure 10 cm on a side. The electric-field energy density between them is 4.5 kJ/m^3 . What's the charge on the plates?

3.

Engineers testing an ultracapacitor (see Application on page 420) measure the capacitor's stored energy at different voltages. The table below gives the results. Determine a quantity that, when you plot stored energy against it, should give a straight line. Make your plot, establish a best-fit line, and use its slope to determine the capacitance.

Voltage (V)	12.2	20.1	31.8	37.9	45.7	50.2	56.0
Energy (kJ)	9.25	27.2	62.5	94	139	158	203

4.

A transmission line consists of two parallel wires, of radius a and separation b , carrying uniform line charge densities $\pm \lambda$, respectively. With $a \ll b$, their electric field is the superposition of the fields from two long straight lines of charge. Find the capacitance per unit length for this transmission line.