Homework, Chapter 2

1) A proton moves 2.00 cm parallel and in the direction of a uniform electric field of \( E = 200 \text{ N/C} \). (a) How much work is done by the field on the proton? (b) What change occurs in the potential energy of the proton? (c) What potential difference did the proton move through?
2) A charged particle accelerated through a potential difference of 60.0 V has its potential energy decreased by $2.42 \times 10^{-17}$ J. Calculate the charge on the particle. Is the charge positive or negative?
3) (a) Find the electric potential 1.00 cm from a proton. (b) What is the electric potential difference between two points that are 1.00 cm and 2.00 cm from a proton?
4) a) Find the electric potential, taking zero at infinity, at the upper right corner (the corner without a charge) of the rectangle in this figure. (b) Repeat if the 2.00-μC charge is replaced with a charge of -2.00 μC.
5) Three charges are situated at corners of a rectangle as in this figure. How much energy is required to assemble these charges, assuming they come from a very far distance away?
6) The electric potential in a region of space is given by \( V = 2xy - 3zx + 5y^2 \), with \( V \) in volts and the coordinates in meters. If point \( P \) is at \( x = 1 \text{ m}, y = 1 \text{ m}, z = 1 \text{ m} \), find (a) the potential at \( P \) and (b) the \( x \), \( y \), and \( z \) components of the electric field at \( P \).
7) A $60.0 \times 10^{-15}$ F capacitor has a plate area of $21.0 \times 10^{-12}$ m$^2$. Determine the plate separation of such a capacitor. (Assume a parallel-plate configuration).

The diameter of an atom is on the order of $10^{-10}$ m = 1 angstrom. How many atoms will fit between the parallel plates of this capacitor.
8) A series circuit consists of a 0.050-μF capacitor, a 0.100-μF capacitor, and a 400-V battery. Find the charge (a) on each of the capacitors and (b) on each of the capacitors if they are reconnected in parallel across the battery.
9) In this figure a 10 V battery is connected across capacitors of capacitances $C_1=2 \mu F$, $C_2=4 \mu F$, $C_3=2 \mu F$, $C_4=12 \mu F$, $C_5=8 \mu F$, and $C_6=8 \mu F$. What is the equivalent capacitance and the voltage and charge for each capacitor?
10) (a) Find the equivalent capacitance of the capacitors in this figure. (b) Find the charge on each capacitor and the potential difference across it.
11) Express the potential due to this charged bar at P in terms of L, d, and \( \lambda \).