a. Calculate the electric potential produced by a +2.0 nC point charge a distance of 3.0 cm away.

\[ V = \frac{Q}{r} = \left( \frac{9 \times 10^9 \text{Nm}^2}{\text{C}^2} \right) \left( 2 \times 10^{-9} \text{C} \right) = \frac{18}{3 \times 10^{-2}} = 600 \text{V} \]

b. A -3.0 nC charge is brought from infinity to a location 3.0 cm away from the +2.0 nC charge. Calculate the work required to perform this operation.

\[ W = \frac{1}{2} k \left( \frac{Q_1 Q_2}{r} \right) = \frac{1}{2} \left( 9 \times 10^9 \text{Nm}^2/\text{C}^2 \right) \left( -3 \times 10^{-9} \text{C} \right) \left( 2 \times 10^{-9} \text{C} \right) = -18 \times 10^{-7} \text{J} \]

c. Two metallic plates are each 20 cm² in area, and separated by 0.20 mm (assume that vacuum is in between) and oppositely charged. Make a sketch of the electric field lines between the plates (show '+' and '-' charges on the plates) and draw the equipotential lines delineating which lines are which.

d. Calculate the capacitance of this capacitor.

\[ C = \frac{\varepsilon_0 A}{d} = \frac{8.854 \times 10^{-12} \text{F/m}^2}{2 \times 10^{-4} \text{m}^2} = 8.854 \times 10^{-11} \times 2 = 17.7 \times 10^{-11} \text{F} = 0.18 \text{nF} \]