

Please show your work on the following problems.

1. There are two particles q_1 and q_2 such that $q_1 = -8q$ is at the origin ($y = 0$) and $q_2 = 2q$ is at $y = L$.

- (a) Draw the electric field lines produced by each charged particle.

- (b) Calculate:

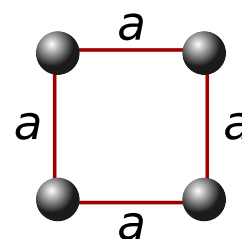
- i. The magnitude of the electric force produced on q_1 by q_2 .

- ii. The electric potential at $y = -L$.

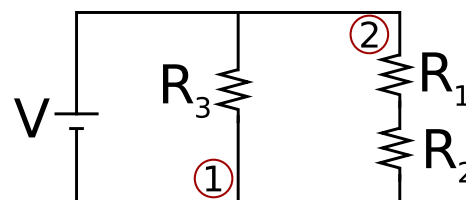
- iii. The magnitude and direction of the electric field at $y = -L$.

- (c) A third particle of charge $q_3 = -q$ is added. Where does it have to be so that it's in equilibrium (i.e. there is no force on it)?

2. How much work is required to set up the arrangement in the figure if $q = 2.3 \text{ pC}$, $a = 64.0 \text{ cm}$, and the particles are initially infinitely far apart and at rest?



3. In the circuit diagram below, $V = 5\text{V}$, $R_1 = 100\Omega$, $R_2 = R_3 = 500\Omega$.



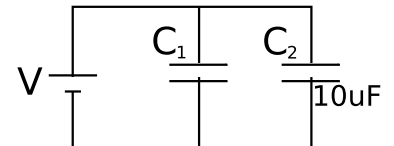
- (a) What is the total resistance of the circuit?

- (b) How much current is flowing through branches 1 and 2 (as labelled)?

4. A capacitor is attached to a $3V$ battery. After a long time, the charge on the capacitor is $5\mu C$.

(a) What is the capacitance?

(b) If a $10\mu F$ is added in parallel to the circuit as shown, how much charge will end up on each capacitor? (Hint: How much voltage is each capacitor getting?)



(c) If that $10\mu F$ capacitor is added in series, how much charge will end up on each cap?