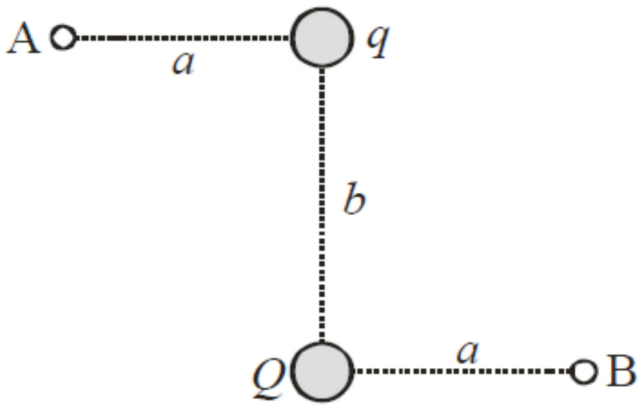
Homework#1

Due on: Sunday 12/05/1437 H

Question#1:

Two Point charges q and Q are positioned as shown. If q = +2.0 nC, Q = –2.0 nC, a = 3.0 m, and b = 4.0 m, what is the electric potential difference, $V_A - V_B$?



$$V_A = K\left[\frac{q}{a} + \frac{Q}{\sqrt{a^2+b^2}}\right]$$

$$V_B = K\left[\frac{Q}{a} + \frac{q}{\sqrt{a^2+b^2}}\right]$$

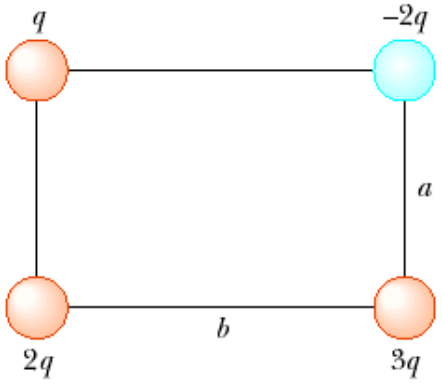
$$q = 2*10^{-9}C \quad Q = -2*10^{-9}C$$

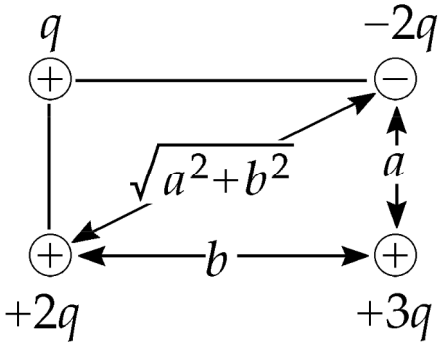
$$V_A - V_B = 9*10^9 * 2*10^{-9} * \left[\frac{1}{3} + \frac{-1}{5} - \frac{-1}{3} - \frac{1}{5}\right] = 4.8V$$

Question#2:

Calculate the energy required to assemble the array of charges shown in Figure,

where a **= 0.2 m,** b **= 0.4 m, and** q **= 6** μ**C**.





$U = \sum \frac{k_e q_i q_j}{r_{ij}}$, summed over all pairs of (i, j) where $i \neq j$.

$$U = k_e \left[\frac{q(-2q)}{b} + \frac{(-2q)(3q)}{a} + \frac{(2q)(3q)}{b} + \frac{q(2q)}{a} + \frac{q(3q)}{\sqrt{a^2 + b^2}} + \frac{2q(-2q)}{\sqrt{a^2 + b^2}} \right]$$

$$U = k_e q^2 \left[\frac{-2}{0.400} - \frac{6}{0.200} + \frac{6}{0.400} + \frac{2}{0.200} + \frac{3}{0.447} - \frac{4}{0.447} \right]$$

$$U = \left(8.99 \times 10^9\right)\left(6.00 \times 10^{-6}\right)^2 \left[\frac{4}{0.400} - \frac{4}{0.200} - \frac{1}{0.447} \right] = \boxed{-3.96\ \text{J}}$$