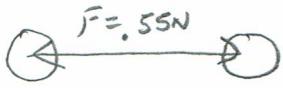
UCONN Physics 1202Q
Electrostatics - Practice Quiz / 65

Name: Key
Date: _____ Period: _____

Directions: Show all your work and label all answers and show steps to solutions. If you show a formula not on the formula sheet, you must show how you got it!! Explain answers when necessary.

1. Two charged bodies exert a force of 0.55 N on each other. What will be the force if they are moved so they are only one fifth (1/5) as far apart? 2 pts [13.75 N]



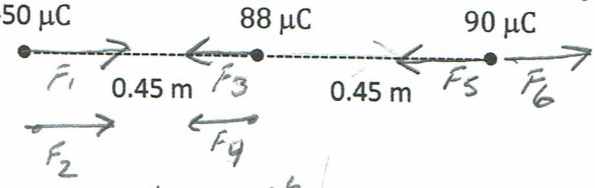
$\therefore F = 1/5 \quad F \propto \frac{1}{r^2} \quad F = \frac{1}{(1/5)^2} = \frac{25}{1}$

$\therefore F = .55N \times 25 = \boxed{13.75\ N}$

2. How many electrons make up a charge of 300 μC? 2 pts [1.875×10^{15} e^-]

$300 \times 10^{-6} C \times \frac{1\ e^-}{1.6 \times 10^{-19} C} = \boxed{1.875 \times 10^{15}\ e^-}$

3. Particles of charge +90, +88, and -50 μC are placed in a line seen below. The center one is 0.45 m from each of the others. Calculate the net force on each due to the other two. 10 pts.



$F = k \frac{Q_1 Q_2}{r^2}$

$F_1 = 9 \times 10^9 \times \frac{50 \times 10^{-6} \times 88 \times 10^{-6}}{(.45m)^2}$

$F_1 = 195.6N$

$F_2 = 9 \times 10^9 \times \frac{50 \times 10^{-6} \times 90 \times 10^{-6}}{(.9m)^2}$

$F_2 = 50N$

$Net = 195.6 + 50N = \boxed{245.6N \text{ right}}$

$F_3 = F_1 \therefore 195.6N$

$F_4 = 9 \times 10^9 \frac{88 \times 10^{-6} \times 90 \times 10^{-6}}{(.45m)^2}$

$F_4 = 352N$

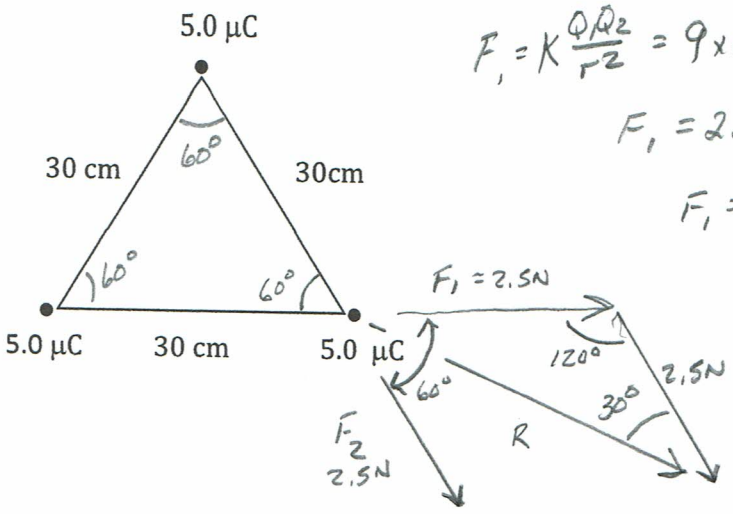
$Net = 195.6N + 352N = \boxed{547.6N \text{ Left}}$

$F_5 = F_2 \therefore 50N$

$F_6 = F_4 \therefore 352N$

$Net = 352N - 50N = \boxed{302N \text{ Right}}$

4. Three positive particles of charges 5.0 μC are located at the corners of an equilateral triangle with 30 cm sides. Calculate the magnitude AND direction of the net force on ~~each~~ one particle. 10 pts. [4.33 N @ 30°]



$F_1 = K\frac{QQ_2}{r^2} = 9\times10^9 \times \frac{5\times10^{-6}C \times 5\times10^{-6}C}{(.3m)^2}$

$F_1 = 2.5N$

$F_1 = F_2 \quad \therefore \quad F_2 = 2.5N$

$c^2 = a^2 + b^2 - 2ab\cos C$

$C = R$

$R^2 = (2.5)^2 + (2.5)^2 - 2(2.5)(2.5)\cos 120°$

$R = 4.33N$

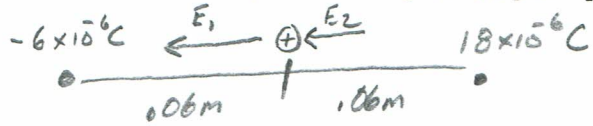
$\frac{\sin a}{A} = \frac{\sin b}{B} = \frac{\sin c}{C}$

$\frac{\sin a}{2.5} = \frac{\sin 120°}{4.33}$

$a = 30°$

$\therefore$ R = 4.33N @ 30° below horizontal

5. What is the magnitude and direction of the electric field at a point midway between a -6.0 μC and a + 18.0 μC charge 12.0 cm apart? 10 pts. [6.0 x 10^7 N/C]



$E_1 = K\frac{Q}{r^2} \quad E_1 = 9\times10^9 \times \frac{6\times10^{-6}C}{(.06)^2} = 1.5\times10^7 N/C$

$E_2 = K\frac{Q}{r^2} \quad E_2 = 9\times10^9 \times \frac{18\times10^{-6}}{(.06)^2} = 4.5\times10^7 N/C$

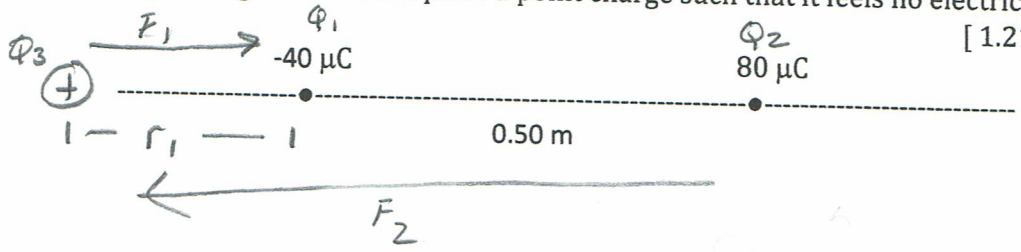
mid point $= E_1 + E_2 = 1.5\times10^7 N/C + 4.5\times10^7 N/C$

$= 6.0 \times 10^7$ N/C Toward Neg Charge

6. What is the acceleration of an electron in a 6500 N/C Electric field? 3 pts.
[1.14×10^{15} m/s^2]

$$E = \frac{F}{Q} = \frac{ma}{Q} \qquad a = \frac{EQ}{m} = \frac{6500 \times 1.6\times10^{-19}}{9.11\times10^{-31}} = \boxed{1.14\times10^{15}\ m/s^2}$$

7. (III) Two charges below are separated by a distance of 0.50 m. Where along the line separating them can we place a point charge such that it feels no electrical force? 10 pts.
[1.21 m left of -40 μC]



$$F_1 = F_2$$

$$K\frac{Q_3 Q_1}{r_1^2} = K\frac{Q_3 Q_2}{(r_1+.5)^2}$$

$$\frac{Q_1}{r_1^2} = \frac{Q_2}{(r_1+.5)^2}$$

$$\frac{40\times10^{-6}}{r_1^2} = \frac{80\times10^{-6}}{(r_1^2+1r_1+.25)}$$

$$40\times10^{-6}r_1^2 + 40\times10^{-6}r_1 + 10\times10^{-6} = 80\times10^{-6}r_1^2$$

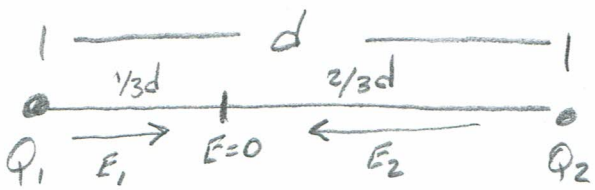
$$-40\times10^{-6}r_1^2 + 40\times10^{-6}r_1 + 10\times10^{-6} = 0$$

* Solve for Quadratic

$$r_1 = 1.21\ m$$

∴ Place test charge @ 1.21 m left of -40μC charge

8. You are given two unknown point charges, Q_1 and Q_2. At a point on the line joining them, one-third of the way from Q_1 to Q_2, the electric field is zero. What can you say about these two charges? 10 pts. [$Q_2 / Q_1 = 4/1$]



$E_1 = E_2$

$K\frac{Q_1}{r_1^2} = K\frac{Q_2}{r_2^2}$

$\frac{Q_1}{r_1^2} = \frac{Q_2}{r_2^2}$

$\frac{Q_1}{(1/3d)^2} = \frac{Q_2}{(2/3d)^2}$

$\frac{Q_1}{1/9d^2} = \frac{Q_2}{4/9d^2}$

$\frac{Q_1}{Q_2} = \frac{1/9d^2}{4/9d^2}$

$\frac{Q_1}{Q_2} = \frac{1/9}{4/9}$

$\frac{Q_1}{Q_2} = \frac{1}{9} \cdot \frac{9}{4} = \frac{1}{4}$

$\frac{Q_1}{Q_2} = \frac{1}{4}$

$4Q_1 = Q_2$

$\therefore Q_2 > Q_1$ (4 times Greater)

9. Examine the drawings below. Determine:

a. Which has a greater E-Field? (A. -10 V) B. -5 V C. -2 V (1 pt) [A]
Why? _____
(Density of E field lines)
_____ 2 pts

b. Calculate the work done to move a charge (q=2C) from -2V to -10 V. 5 pts.
(with Gran) (Naturally)

$W = q\Delta V = 2C(-2 - -10) = 2C(8V) = 16J$