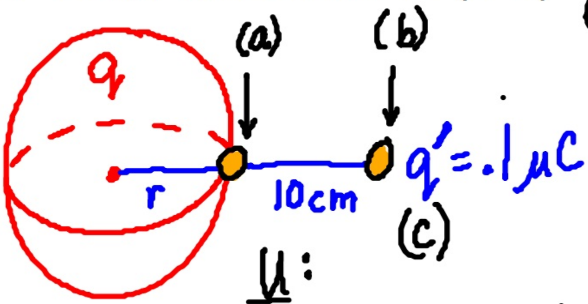
Electric Field Examples:

p. 198, Exercise #20 (a-c)



G:

r = 10 cm

$q = 2\,\mu C$

$K = 8.99 \times 10^9\ Nm^2/C^2$

U:

(a) $E_{(a)} =$ ___ NC^{-1}

(b) $E_{(b)} =$ ___ NC^{-1}

E:

(a) $E = \frac{Kq}{r^2} = \frac{(8.99 \times 10^9)(2 \times 10^{-6})}{(.1)^2}$

$E = 2 \times 10^6\ N/C$

$E = 2 \times 10^6\ NC^{-1}$

(b) $E \propto \frac{1}{r^2}$

$E \downarrow,\ r^2 \uparrow$

$E = \frac{Kq}{r^2} = \frac{(8.99 \times 10^9)(2 \times 10^{-6})}{(.2)^2}$

$E = 4 \times 10^5\ N/C$ or NC^{-1}

(c) $F_E = Eq$

$F_E = (4 \times 10^5\ NC^{-1})(.1 \times 10^{-6}\ C)$

$F_E = 0.04\ N$ or $4 \times 10^{-2}\ N$

Electric Field Examples:

p. 198, Exercise #21 (a-b)

G:

$m = 0.01\ kg$

$q = 0.2\ \mu C = 0.2 \times 10^{-6}\ C$

$E = 0.5\ NC^{-1}$

$K = 8.99 \times 10^{9}\ Nm^2C^{-2}$

U:

(a) $F_E = \_\_\_\ N$

(b) $a = \_\_\_\ ms^{-2}$

E:

(a) $E = \frac{F_E}{q}$

$\therefore F_E = Eq$

$F_E = (0.5)(.2 \times 10^{-6})$

$F_E = 1 \times 10^{-7}\ N$

E:

(b) $F_{net} = ma$

$\frac{F_E}{m} = \frac{ma}{m}$

$\therefore a = \frac{F_E}{m} = \frac{(1 \times 10^{-7})}{(.01)}$

$a = 1 \times 10^{-5}\ ms^{-2}$

Electric Field Examples:

The electric field between two parallel plates is 100.0 NC^{-1}. What acceleration would a charge of 2.0 μC and a mass 1.0×10^{-3} kg experience if placed in the field? (Ignore its weight.)

$E = 100.0\ NC^{-1}$

$q = 2.0 \times 10^{-6} C$

$m = 1.0 \times 10^{-3} kg$

$K = 8.99 \times 10^{9}\ Nm^2C^{-2}$

U:

$a = \_\_\_ ms^{-2}$

E:

$F_{net} = ma$

$F_E = Eq$

$F_{net} = F_E$

$\therefore \frac{Eq}{m} = \frac{ma}{m}$

$a = \frac{Eq}{m}$

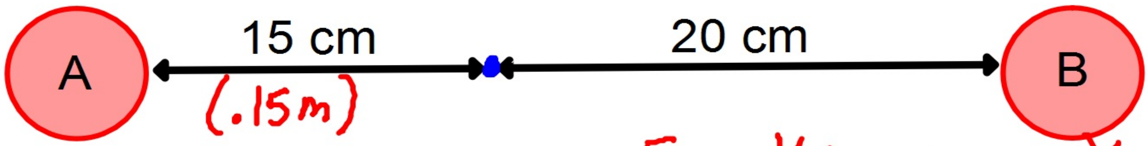
$a = \frac{(100.0)(2 \times 10^{-6})}{(1 \times 10^{-3})}$

$a = .20\ ms^{-2}$

or $2.0 \times 10^{-1}\ ms^{-2}$

Electric Field Examples:

Two +15.0 μC charges are separated by 35 cm. What is the field strength between the charges 15 cm from A?



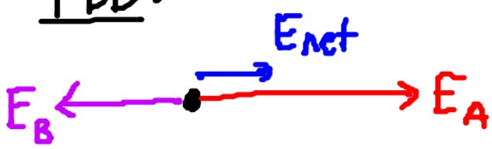
$$E_A = \frac{kq}{r_A^2} = \frac{(8.99\times10^9)(15\times10^{-6})}{(.15)^2}$$

$$E_A = 5993333 = 6.0\times10^6\ NC^{-1}$$

$$E_B = \frac{kq}{r_B^2} = \frac{(8.99\times10^9)(15\times10^{-6})}{(.20)^2}$$

$$E_B = 3371250 = 3.4\times10^6\ NC^{-1}$$

FBD:



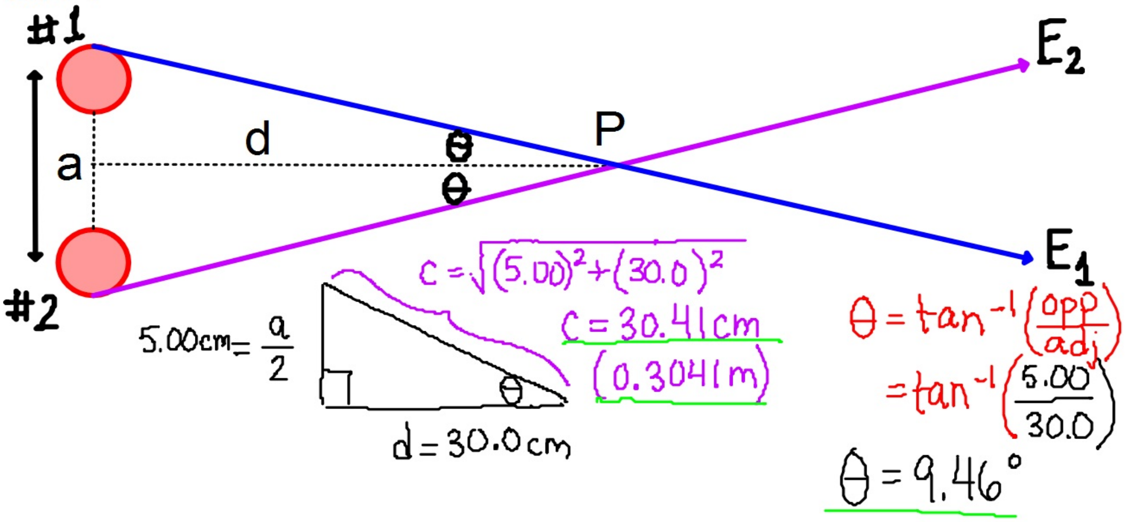
ΣE:

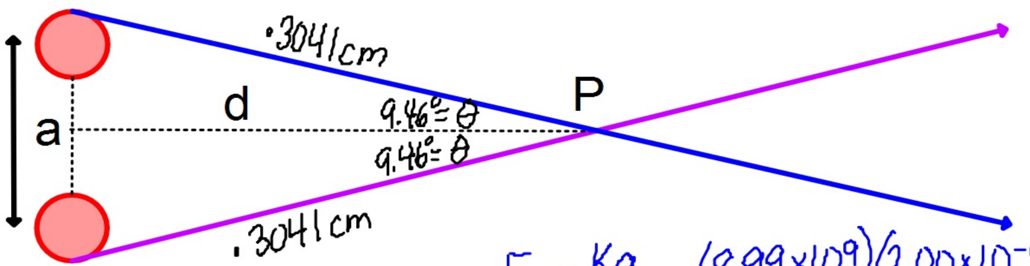
$$E_{net} = E_A - E_B$$

$$= 2.6\times10^6\ NC^{-1}$$

Electric Field Examples:

Consider two equal positive charges, each 2.00 μC, separated by a = 10.0 cm and a point P a distance of d = 30.0 cm as shown in the figure below. Find the magnitude and direction of the net electric field at P.



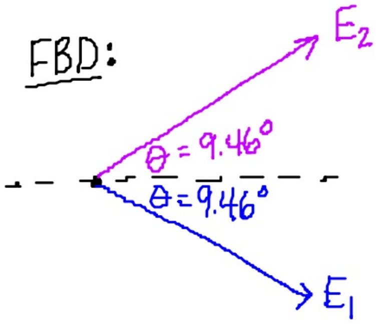


$$E_1 = \frac{Kq_1}{r_1^2} = \frac{(8.99\times10^9)(2.00\times10^{-6})}{(.3041)^2} =$$

$$E_2 = \frac{Kq_2}{r_2^2} = \frac{(8.99\times10^9)(2.00\times10^{-6})}{(.3041)^2} =$$

$$194427.1218 \approx 1.94\times10^4\ NC^{-1}$$

FBD:



$E_1 = E_2$

$E_{net} = 3.84\times10^5\ NC^{-1}$ in $+x$ direction

ΣE:

$$\Sigma E_x = E_1\cos\theta + E_2\cos\theta = 2E_1\cos\theta = 2(1.94\times10^4\ NC^{-1})\cos(9.46°) = 383566.0$$

$$\Sigma E_y = E_2\sin\theta - E_1\sin\theta = \emptyset\ N$$

Electric Field Practice Problems:
pg. 296-297 (#1, 3, 5, 6, 8, 11, 12, 13a-b, 14a)
Show all of your work on a separate sheet of paper.
Due next class period.