PHYS102.10
Quiz # 6

Name: Key Id#:

A charge of 5 μC is placed at coordinates (0, 3.0 m) and an 8 μC charge is placed at coordinates (4.0 m, 0).

(a) If both charges are held fixed, what is the magnitude of the electric field at the origin?

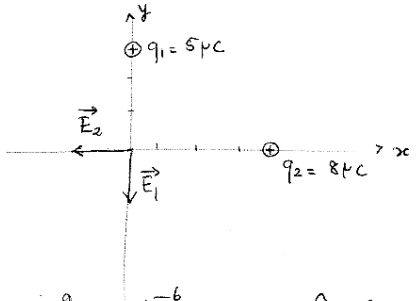
(b) If an electron is placed at the origin, what is the magnitude of the force on it?

a)

$$\vec{E}_1 = -\frac{kq_1}{r^2}\hat{j}$$

$$= -\frac{9\times10^9 \times 5\times10^{-6}}{(3)^2}\hat{j}$$

$$= -5000\,\hat{j}\ (N/C)$$



$$\vec{E}_2 = -\frac{kq_2}{r_2^2}\hat{i} = -\frac{9\times10^9 \times 8\times10^{-6}}{(4)^2}\hat{i} = -4500\,\hat{i}\ (N/C)$$

$$\vec{E}_{net} = -4500\,\hat{i} - 5000\hat{j}\ \ N/C$$

Magnitude: $\boxed{|\vec{E}_{net}| = 6727\ N/C}$

b) $\vec{F} = q\vec{E}$

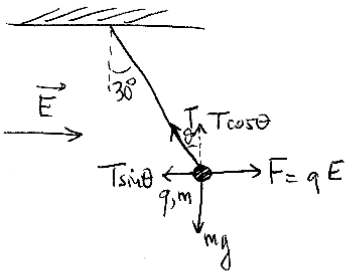
$$|\vec{F}| = 1.6\times10^{-19} \times 6727 = \boxed{1.1\times10^{-15}\ N}$$

PHYS102.11
Quiz # 6

Name: Id#:

A charged plastic ball of mass 10 g is suspended from a light string in the presence of a uniform electric field given by $\vec{E} = 2.0 \times 10^5 \hat{i}$ (N/C). The ball is in equilibrium when $\theta = 30^0$. Find

(a) the electric charge on the ball
(b) the tension in the string



a) x-axis:

$$qE = T\sin\theta \quad -(1)$$

Y-axis

$$mg = T\cos\theta \quad -(2)$$

$$\frac{(1)}{(2)} = \frac{qE}{mg} = \tan\theta \Rightarrow q = \frac{mg}{E}\tan\theta$$

$$q = \frac{0.01 \times 9.8 \times \tan 30^\circ}{2\times 10^5} = \boxed{2.8\times 10^{-7}\ C}$$

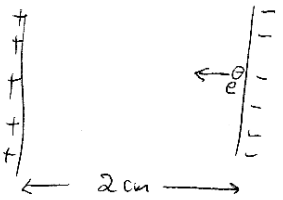
b) $$T = \frac{mg}{\cos\theta} = \boxed{0.113\ N}$$

PHYS102.12
Quiz # 6

Name: Key Id#:

A uniform electric field exists in a region between two oppositely charged plates. An electron is released from rest at the surface of the negatively charged plates and strikes the surface of the opposite plate 2.0 cm away, in a time 2ms.

(a) What is the speed of the electron as it strikes the second plate?
(b) What is the magnitude of the electric field between the plates?



a) $v = \cancel{v_0^{0}} + at$

$x = \frac{1}{2} a t^2 \Rightarrow a = \frac{2x}{t^2} = 10{,}000 \text{ m/s}^2$

$v = 10{,}000 \times 0.002 = \boxed{20 \text{ m/s}}$

b) $qE = ma \Rightarrow E = \frac{ma}{q} = \frac{9.1 \times 10^{-31} \times 10{,}000}{1.6 \times 10^{-19}}$

$$\boxed{E = 5.7 \times 10^{-8} \text{ N/C}}$$