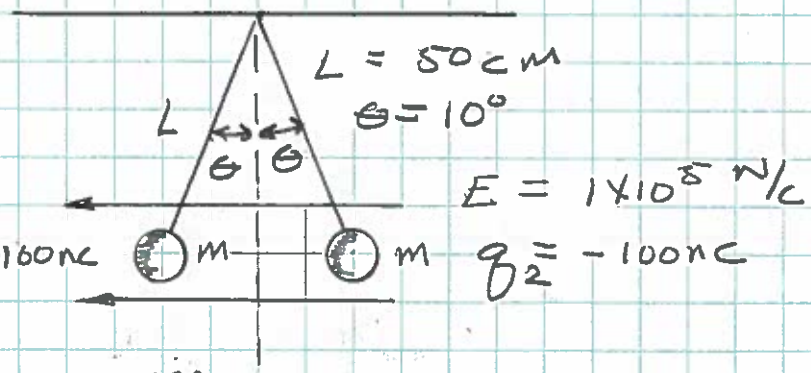
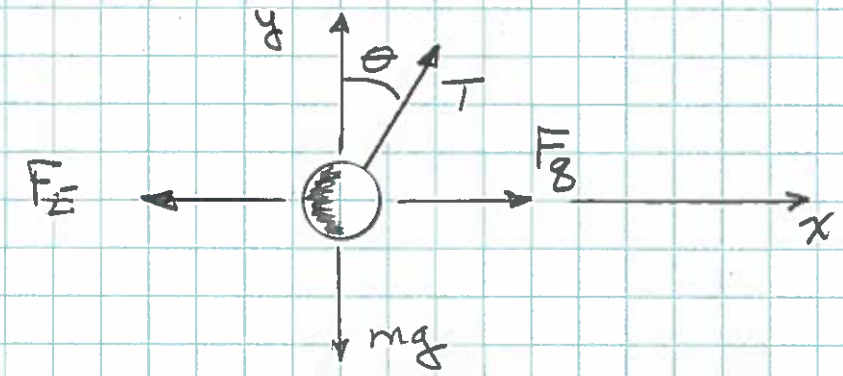


find mass m

FBD of + charge



NOTE: F_E = force from electric field $\vec{E}$

$= q_1 E$

F_g = force from negative charge q_2

$= \frac{K|q_1||q_2|}{r^2} = \frac{Kq^2}{r^2}$ $\quad q = 100nC$

and $r = 2L\sin\theta$

$$F_g = \frac{Kq^2}{2L^2\sin^2\theta}$$

Also, a FBD of the negative charge is the same.

Now, apply Newton's Second Law for equilibrium:

$$\Sigma F_x = T\sin\theta + F_g - F_E = 0 \qquad (1)$$

$$\Sigma F_y = T\cos\theta - mg = 0 \qquad (2)$$

or,

$$T\sin\theta = F_E - F_g \qquad (1)$$

$$T\cos\theta = mg \qquad (2)$$

Divide equ'n (1) by equ'n (3):

$$\frac{T\sin\theta}{T\cos\theta} = \tan\theta = \frac{F_E - F_g}{mg}$$

and,

$$mg\tan\theta = qE - \frac{kq^2}{4L^2\sin^2\theta}$$

$$m = \frac{1}{g\tan\theta}\left[qE - \frac{kq^2}{4L^2\sin^2\theta}\right]$$

$$= 0.0041 \text{ kg}$$

$$\therefore \quad m = 4.1 \text{ g}$$