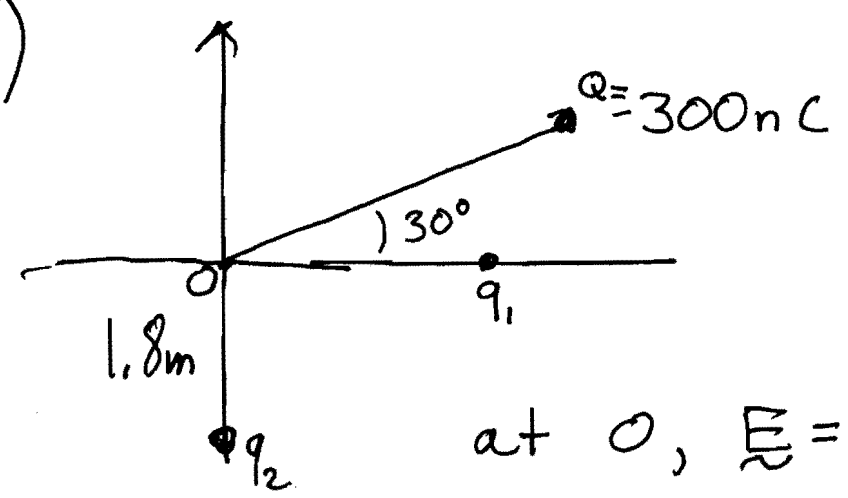
Quiz 1 solutions

1)



at O, $\underset{\sim}{E} = 0$

$$E_{Q\,at\,O} = \frac{K(-300nC)}{2^2}\underbrace{\cos(30)}_{x\text{ comp}}\underbrace{(-1)}_{\hat{r}}\hat{\imath}$$

$$+\frac{K(-300nC)}{2^2}\sin 30(-1)\hat{\jmath}$$

$$E_{q_1\,at\,O} = \frac{Kq_1}{1.6^2}(-1)\hat{\imath}$$ so to cancel out the $\hat{\imath}$ part of $E_{Q\,at\,O}$

$$\frac{Kq_1}{1.6^2} = -\frac{K(-300nC)}{2^2}\cos(30)$$

$$q_1 = \frac{1.6^2}{2^2}\cos(30)(300nC) = 166.3\,nC$$

2) to cancel out the $\hat{\jmath}$ part

$$\frac{Kq_2}{1.8^2}\hat{\jmath} + \frac{K(-300nC)}{2^2}\sin 30(-1)\hat{\jmath} = 0$$

$$q_2 = \frac{1.8^2}{2^2}(-300nC)\sin 30 = -121\,nC$$

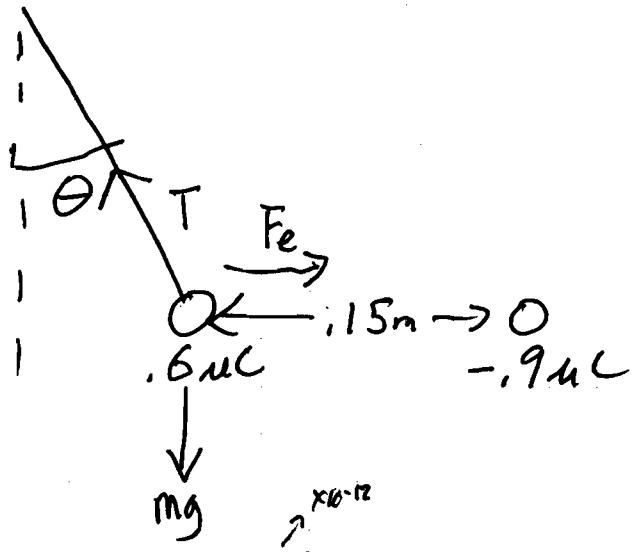
3) $q_1 + q_2 = -24\mu C$ $\quad \frac{K q_1 q_2}{r^2}\hat{r} = -10.8N$ (it's attractive)

$r = .60m$ $\quad q_1 = -24 - q_2$

$$\frac{K(-24-q_2)q_2}{r^2} = -10.8$$

$q_2 = -36\mu C$, $12\mu C$

4)



$$F_e = \frac{K(.54\mu C^2)}{.15^2} = T\sin\theta \qquad \frac{K .54\times10^{-12}}{mg\,.15^2} = \tan\theta$$

$$mg = T\cos\theta \qquad \theta = \tan^{-1}\left(\frac{K .54\times10^{-12}}{mg\,.15^2}\right)$$

no tetha + this is small so $\arctan(x) \approx x$ in radians

$\theta = 10.4°$