P 21.4 #1

$m = 10.8\,g$

$mat = 197\,g/mol$

$nat = 79$

a) # Protones

$$10.8\,g \times \frac{1\,mol}{197\,g} \times \frac{6.022 \times 10^{23}\,at}{1\,mol} \times \frac{79\,P}{1\,at} = 2.61 \times$$

$$\text{Carga positiva} = (2.61 \times 10^{24}\,p)(1.6022 \times 10^{-19}\,c/p) = 4.18 \times 10^{5}\,C$$

Protones: 2.61×10^{24} p.

$Q+ = 4.18 \times 10^{5}$ C.

b) # electrones = # Protones

electrones: 2.61×10^{24} e

P. 21.11 #2

a) $\oplus^{1}$ ——— $\oplus^{2}$ 2.50 mm.

$F = ma$

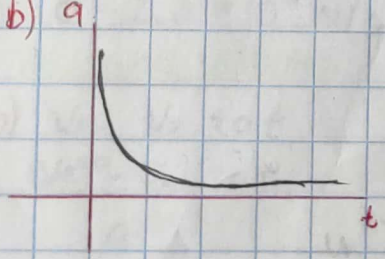
$a = \frac{F}{m}$

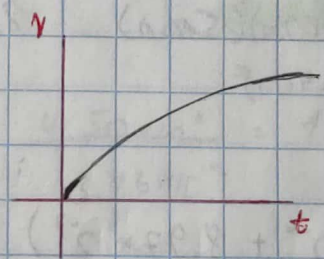
$$F_e = \frac{K q_p^2}{r^2} = \frac{9 \times 10^{9} (1.6 \times 10^{-19})^2}{(0.00250)^2} = 3.69 \times 10^{-23}\,N$$

$$a = \frac{3.69 \times 10^{-23}}{1.67 \times 10^{-27}} = 22074.2\,m/s^2$$

$a = 2.21 \times 10^{4}\,m/s^2$

b)





P. 21.34 #3

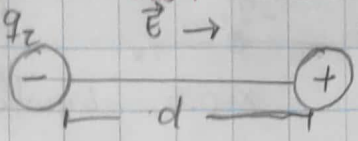
$q_1 = 8.75\ \mu C$

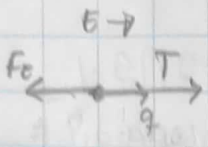
$q_2 = -6.50\ \mu C$

$d = 2.50\ cm$

$|E| = 1.85 \times 10^8\ N/C$

a)





$F_E = qE$

$F_E = (6.50 \times 10^{-6})(1.85 \times 10^8)$

$F_E = 1.20 \times 10^3\ N.$

$$F_T = \frac{k|q_1||q_2|}{r^2} = \frac{k(8.75\ \mu)(6.50\ \mu)}{(0.0250)^2} = 8.18 \times 10^2 N$$

$\Sigma F_x = 0$

$T + F_T - F_E = 0$

$T = F_E - F_T$

$T = (1.20 \times 10^3) - (8.18 \times 10^2)$

$T = 382\ N.$

$T = 382\ N.$

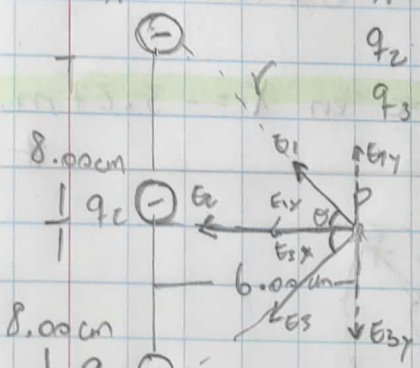
b) Si q_1 y q_2 son +.

$T = 2.02 \times 10^3\ N.$

$T = F_E + F_T$

$T = (1.20 \times 10^3) + (8.18 \times 10^2) = 2.02 \times 10^3 N.$

P. 21.41 #4



$q_1 = -5.00\ \mu C$

$q_2 = -2.00\ \mu C$

$q_3 = -5.00\ \mu C.$

$\theta = \tan^{-1}\left(\frac{0.08}{0.06}\right) =$

$\theta = 53.13°$

$E_1 = E_3$

$E_y = 0$

$E_x = 2E_{1x} + E_{2x}$

$r^2 = 8^2 + 6^2 = \sqrt{100}$

$r = 10 = 0.1\ m$

$$E_1 = \frac{k(5\ \mu)}{(0.1)^2} = 4.49 \times 10^6\ N/C$$

$E_{1x} = E\cos\theta = (4.49 \times 10^6)\cos 53.13 = 2.7 \times 10^6\ N/C$

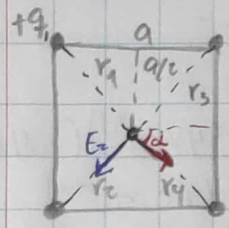
$E_{3x} = 2.7 \times 10^6\ N/C.$

$$E_{2x} = E_2 = \frac{k(2\ \mu)}{(0.06)^2} = 4.99 \times 10^6\ N/C.$$

$E_x = 4.99 \times 10^6 + 2(2.7 \times 10^6) = 1.04 \times 10^7\ N/C$ (-x).

$|E| = 1.04 \times 10^7\ N/C$ (-x)

[P. 21.42] #5



$r_1 = r_2 = r_3 = r_4$

$r_1 = \sqrt{(a/2)^2 + (a/2)^2}$

$r_1 = a/\sqrt{2}$

$\text{Sen}\theta = \text{Sen}\,4 = \frac{\sqrt{2}}{2}$

Por simetría $\sum \vec{E}_x = 0$

$\vec{E}_T = \vec{E}_1 + \vec{E}_2 + \vec{E}_3 + \vec{E}_4$

$\vec{E}_T = \vec{E}_{1y} + \vec{E}_{2y} + \vec{E}_{3y} + \vec{E}_{4y} = 4\vec{E}_{1y}$

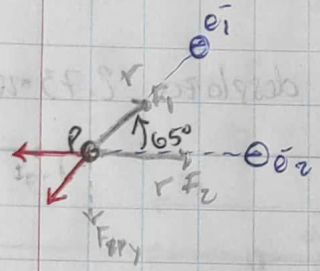
$E_{1y} = \frac{k|q_1|}{r_1^2}\,\text{Sen}\theta\,(-\hat{j})$

$\vec{E}_{1y} = \frac{kq}{\frac{a^2}{2}}\left(\frac{\sqrt{2}}{2}\right)\hat{j} = -\frac{kq\sqrt{2}}{a^2}\,\hat{j}$

$\vec{E}_T = -\frac{4\sqrt{2}kq}{a^2}\,\hat{j}$

$\vec{E}_T = \frac{4\sqrt{2}kq}{a^2}(-\hat{j})$ ✓

[P. 21.45] #6



$\theta = 65°$

$r = 1.50\times10^{-10}\,m$

$F_{1px} = F_1\cos\theta$

$F_{1py} = F_1\,\text{Sen}\,\theta$

$\vec{F}_T = \vec{F}_{1p} + \vec{F}_{2p}$

$F_{1px} = \frac{kq_1q_{p+}}{(1.50\times10^{-10})^2}\cos\theta = \frac{k(1.6022\times10^{-19})(1.6022\times10^{-19})\cos65°}{(1.50\times10^{-10})^2} =$

$F_{1px} = 4.33\times10^{-9}\,N.$

$F_{1py} = \frac{k(1.6022\times10^{-19})^2}{(1.50\times10^{-10})^2}\,\text{Sen}\,65° = 9.30\times10^{-9}\,N$

$\vec{F}_{2px} = \frac{k(1.6022\times10^{-19})^2}{(1.50\times10^{-10})^2} = 1.027\times10^{-8}\,N.$

$F_T = \sqrt{(F_{1px} + F_{2px})^2 + (F_{1y})^2} = \sqrt{(1.46\times10^{-8})^2 + (9.30\times10^{-9})^2}$

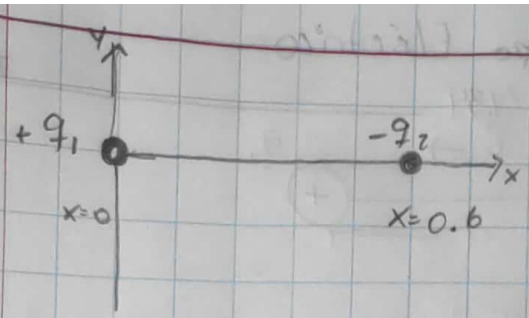
$F_T = 1.73\times10^{-8}\,N$

$\theta = \text{Tan}^{-1}\left(\frac{9.30\times10^{-9}}{1.46\times10^{-8}}\right) = 32.4°$

$F_T = 1.73\times10^{-8}\,N$

$\theta = 32.4°$ ✓

P 21.60 #7



$q_1 = +2.50\ \mu C$

$q_2 = -3.50\ \mu C$

$F_1 = F_2$

$$F_1 = \frac{K|q||q_1|}{r^2}$$

$$F_2 = \frac{K|q||q_2|}{(r+0.6)^2}$$

$$\frac{K|q||q_1|}{r^2} = \frac{K|q||q_2|}{(r+0.6)^2}$$

$$\frac{|q_1|}{|q_2|}(r+0.6)^2 = r^2$$

$$r = \sqrt{\frac{|q_1|}{|q_2|}}(r+0.6) = \sqrt{\frac{q_1}{q_2}}(r) + \sqrt{\frac{q_1}{q_2}}(0.6)$$

$$r - \sqrt{\frac{|q_1|}{|q_2|}}\,r = \sqrt{\frac{|q_1|}{|q_2|}}(0.6)$$

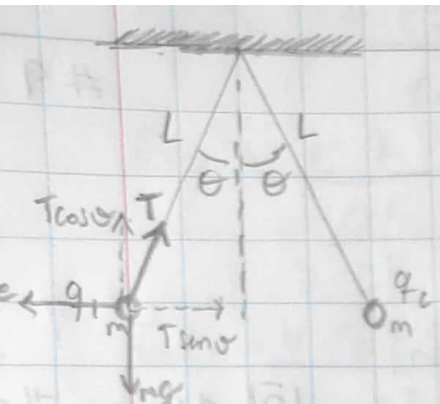
$$r\left(1 - \sqrt{\frac{|q_1|}{|q_2|}}\right) = \sqrt{\frac{|q_1|}{|q_2|}}(0.6)$$

$$\Rightarrow \quad r = \frac{\sqrt{\frac{|q_1|}{|q_2|}}(0.6)}{1 - \sqrt{\frac{|q_1|}{|q_2|}}}$$

$$r = \frac{(0.8452)(0.6)}{1 - 0.8452} = 3.27\,m.$$

$F_N = 0$ en $X = -3.27\,m.$

#8



masa = m. [P.21.62]

longitud = L

$q_1 = q_2 = q$

$\tan\theta \cong \sin\theta = d/2L$

$$d = \left(\frac{q^2 L}{2\pi\varepsilon_0 mg}\right)^{1/3}$$

$\Sigma F_x = 0$

$\Sigma F_y = 0$

$\Sigma F_x = 0$

$T\sin\theta - F_e = 0$

$T = \frac{F_e}{\sin\theta}$

$\Sigma F_y = 0$

$T\cos\theta - mg = 0$

$T = \frac{mg}{\cos\theta}$

$T = T$

$F_e = \frac{mg\sin\theta}{\cos\theta}$ $\tan\theta$

$\frac{kq^2}{d^2} = \tan\theta\, mg$

$\frac{kq^2}{d^2} = \frac{d}{2L} mg \Rightarrow d^3 = \frac{kq^2 2L}{mg} = \left(\frac{q2L}{2\pi\varepsilon_0 mg}\right)^{1/3}$

$$d^3 = \frac{kq^2 2L}{mg}$$

P 21.75 #9

$r = 5.29 * 10^{-11}$ m.

$F = ma \Rightarrow a = \frac{v^2}{r}$

$F = m\frac{v^2}{r}$

$F = F_e$

$F_e = k\frac{e^2}{r^2}$

$m\frac{v^2}{r} = k\frac{e^2}{r^2}$

$v = 2.19 * 10^6$ m/s

$v^2 = \frac{ke^2}{mr}$

$v = \sqrt{\frac{ke^2}{mr}} = \sqrt{\frac{k(1.60*10^{-19})^2}{(9.109*10^{-31})(5.29*10^{-11})}} = 2.19*10^6$ m/s.