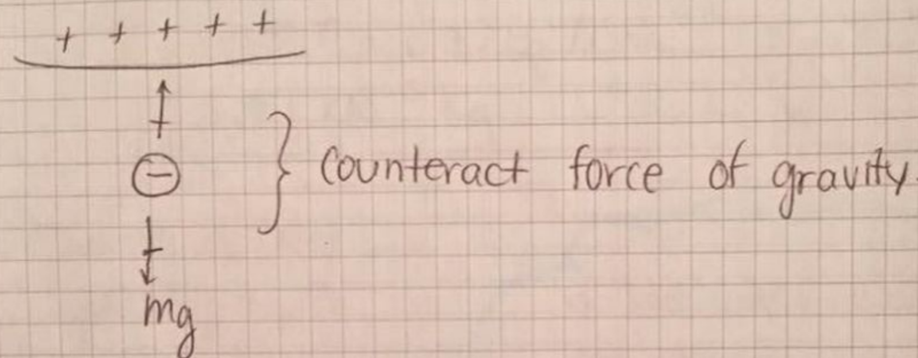
Unit 4; Activity 8 Assignment **By: Eszter Borbely**

1\. a) The latex sphere must be charged negatively, since the charge of the plates above are positive. This way the sphere will be attracted to the plate above, and repelled by the plate below. To balance the force of gravity, the electric force must be in the up direction.



b) $\mathcal{E} = \frac{F}{q} = \frac{\Delta V}{\Delta d}$

$= \frac{460V}{2.5cm}$

$= \frac{460V}{0.025m}$

$= 18400\ N/C$

$\mathcal{E} = 1.84 \times 10^4\ N/C$

* $\mathcal{E} = V/m = N/C$

∴ The field is directed down, The magnitude of the electric field intensity between the plates is $1.84 \times 10^4\ N/C$.

c) $F_e = \mathcal{E} \cdot q = mg$

$q = \frac{mg}{\mathcal{E}}$

$= \frac{(1.5 \times 10^{-15} kg)(9.81 m/s^2)}{(1.84 \times 10^4 N/C)}$

$q = 8.0 \times 10^{-19} C.$

∴ The magnitude of the charge on the latex sphere is $8.0 \times 10^{-19} C$.

d) $N = \frac{q}{e}$

$= \frac{8.0 \times 10^{-19} C}{1.6 \times 10^{-19} C}$

$= 5$

∴ The sphere has 5 excess electrons.

6 a) Givens:

$V = 85V$

$B = 0.75T = 0.75 kg/C \cdot s$

$m_e = 9.1 \times 10^{-31} kg$

Required:

$v = ?$

$F_M = ?$

$r = ?$

$\Delta E_e = -q\mathcal{E}\Delta d$

$qV = \frac{1}{2}mv^2$

$v = \sqrt{\frac{2qV}{m}}$

$= \sqrt{\frac{2(1.6 \times 10^{-19} C)(85V)}{9.1 \times 10^{-31} kg}}$

$= 5.46 \times 10^6 m/s$

∴ $v = 5.5 \times 10^6 m/s$

∴ The initial speed of the electron upon entering the magnetic field is $5.5 \times 10^6 m/s$.

b) $F = B \cdot I$

$= (0.75 kg/C \cdot s)(5.46 \times 10^6 m/s)(1.6 \times 10^{-19} C)(\sin 90°)$

$= 6.55 \times 10^{-13} N$

$= 6.6 \times 10^{-13} N.$

∴ The magnitude of the force is $6.6 \times 10^{-13} N$ [North / UP]. (right hand rule ⇒ determines direction) c.)

$$F_c = \frac{mv^2}{r}$$

$$r = \frac{mv^2}{F_c}$$

$$= \frac{(9.11 \times 10^{-31} kg)(5.46 \times 10^{6} m/s)^2}{6.55 \times 10^{-13}}$$

$$r = 4.15 \times 10^{-5} m$$

∴ The radius of the circular path is 4.15×10^{-5} m.

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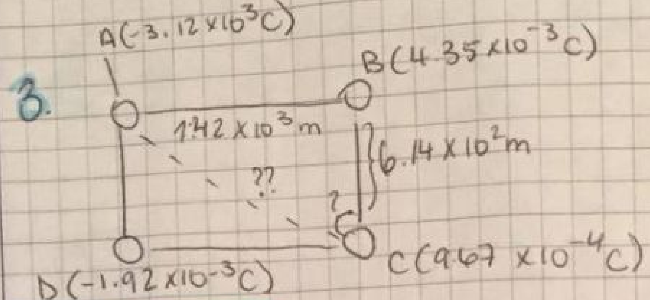


$$? \Rightarrow \tan\theta = \frac{1.42\times10^{3}\,m}{6.14\times10^{2}\,m}$$

$$\theta = \tan^{-1}\left(\frac{1420}{614}\right)$$

$$= 66.6166$$

$$= 66.6$$

$$\theta = 67°$$

$$F_e = \frac{kq_1q_2}{r^2}$$

$$?? \Rightarrow d = \sqrt{(1420)^2 + (614)^2}$$

$$d = 1547.060438\,m$$

$$\therefore d = 1547\,m$$

A on C:

$$F_e = \frac{(8.99\times10^{9})(3.12\times10^{-3})(9.67\times10^{-4})}{(1547)^2}$$

$$= 0.011332512\,N\,[N66°E]$$

$$F_{ex} = (0.11332512)(\sin 66°)$$

$$= 0.01040177\,N\,[W]$$

ATTRACTION

$$F_{ey} = (0.11332512)(\cos 66°)$$

$$= 0.00449766\,N\,[N]$$

ATTRACTION

D on C:

$$F_e = \frac{(8.99\times10^{9})(1.92\times10^{-3})(9.67\times10^{-4})}{(1420)^2}$$

$$= 0.008277719\,N\,[W]$$

ATTRACTION

B on C:

$$F_e = \frac{(8.99\times10^{9})(4.35\times10^{-3})(9.67\times10^{-4})}{(614)^2}$$

$$= 0.100308718\,N\,[S]$$

REPELLING

X

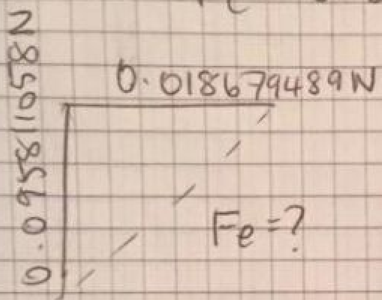
$F_e = (0.01040177) + (0.0082777719)$

$= 0.018679489 \text{ N [W]}$

Y

$F_e = (-0.100308718) + (0.00449766)$

$F_e = 0.095811058 \text{ N [S]}$



$\tan\theta = \left(\frac{0.0958}{0.0186}\right)$

$\theta = \tan^{-1}\left(\frac{0.0958}{0.0186}\right)$

$\theta = 79°$

$F_e = \sqrt{(0.09581)^2 + (0.0180)^2}$

$= 9.76149 \times 10^{-2} \text{ N}$

$= 9.76 \times 10^{-2} \text{ N [W 79° S]}$

∴ The net electrostatic force acting on C is 9.76×10^{-2} N [W 79° S]