ELECTRIC FIELD:

~~Question 01~~

$E_e = 100\ N/C$

~~$F_g = G m_e m_e = Ee$~~

~~$\frac{F_g}{F_e} = \frac{}{Re^2}$~~

~~$\frac{F_g}{F_e} = \frac{6.67\times10^{-11}\times1.67\times10^{-27}\times6\times10^{24}}{(6\times10^{6})^2} \times \frac{1}{100}$~~

~~$= F_e = Ee = 100\times1.6$~~

$= \frac{q\times10^{9}}{(0.075)^2} \times (2\times10^{-7})$

$E = 6.4\times10^{3}\ N/C$

$E = F/q$

$\frac{Kq_1q_2}{r^2} = \frac{1}{2}$

Q5

$E = 1\ N/C$

$r = 1\ m$

$q = ?$

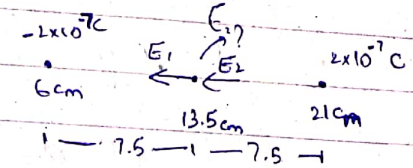
$E = \frac{Kq}{r^2}$

$\frac{Er^2}{K} = q$

$q = \frac{1}{9\times10^{9}}$

$q = 1.11\times10^{-10}\ C$

Q6



$E at_{0.135m} = ?$

$E = E_1 + E_2$

$= \frac{Kq_1}{r^2} + \frac{Kq_2}{r_2}$

$= \frac{K}{r^2}(+2\times10^{-7} + 2\times10^{-7})$

$=$

E. F/q

Question 04:-

E for an electron = ?
E for a proton = ?

a) To balance the weight of an electron:

The gravitation force & electric force must be equal.

$F_e = F_g$

$Eq = mg$

$E = \frac{m_e g}{e}$

$= \frac{9.109 \times 10^{-31} \times 9.8}{1.6 \times 10^{-19}}$

$E = 5.57 \times 10^{-11}$ N/C

b) For proton

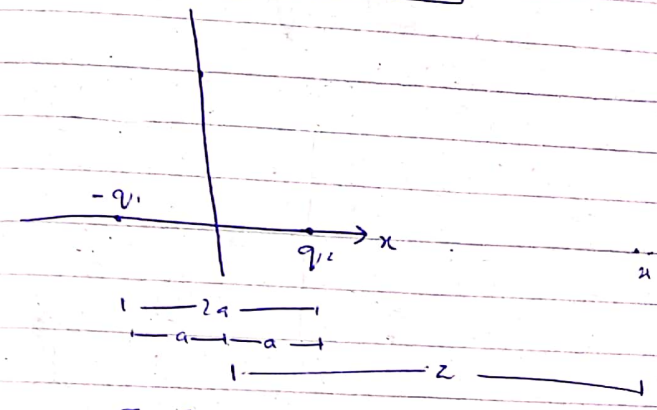
on next page

$F_e = F_g$

$Eq = mg$

$E = \frac{m_p g}{e} = \frac{1.67 \times 10^{-27} \times 9.8}{1.6 \times 10^{-19}}$

$E = 9.8 \times 10^{-8}$ N/C



$E = E_1 + E_2$

$= \frac{Kq}{r_+^2} - \frac{Kq}{r_-^2}$

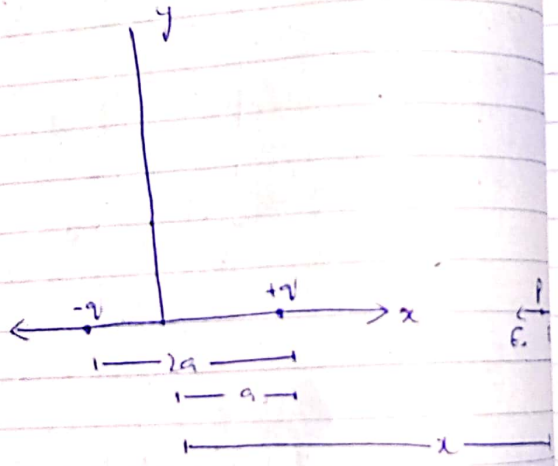
$= \frac{Kq}{(z-a)^2} - \frac{Kq}{(z+a)^2}$

$= Kq \left(\frac{(z+a)^2 - (z-a)^2}{(z-a)^2 (z+a)^2} \right)$

$= Kq\left(\frac{z^2+2az+a^2-(z^2-2az+a^2)}{(z-a)^2(z+a)^2}\right)$

$= Kq\left(\frac{4az}{(z+a)^2}\right)$

$= Kq\left(\frac{az}{(z^2+a^2-2az)(}\right.$



$E = E_1 - E_2$

$= \frac{Kq}{r_1^2} - \frac{Kq}{r_2^2}$

$F_{3y} = F_{31}\sin\theta \qquad \theta = 45°$

$= Kq\left(\frac{1}{r_1^2} - \frac{1}{r_2^2}\right)$

$\because r_1 = x-a \quad ; \quad r_2 = x+a$

$= Kq\left(\frac{1}{(x-a)^2} - \frac{1}{(x+a)^2}\right)$

$= Kq\left[\frac{(x+a)^2-(x-a)^2}{(x-a)^2(x+a)^2}\right]$

$= Kq\left(\frac{x^2+2ax+a^2-x^2+2ax-a^2}{(x^2-2ax+a^2)(x^2+2ax+a^2)}\right)$

$= \frac{4axKq}{x^4+2ax^3+a^2x^2-4a^2x^2-2ax^3-2a^3x+a^2x^2+2ax^3+a^4}$

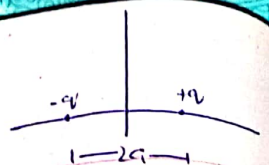
$= \frac{4axKq}{x^4-2a^2x^2+a^4}$

$E = \frac{4axKq}{(x^2-a^2)^2}$

$= \frac{4axKq}{(x^2(1+\frac{a^2}{x^2}))^2} = \frac{4axKq}{x^4(1+\frac{a^2}{x^2})^2}$

$= \frac{4axKq}{x^3(1+\frac{a^2}{x^2})^2} = 4aK$

Q20



$= \frac{Kq}{x^2} - \frac{Kq}{r_2^2}$

$= Kq\left(\frac{1}{x^2} - \frac{1}{r_2^2}\right)$

$= Kq\left(\frac{1}{(x-a)^2} - \frac{1}{(x+a)^2}\right)$

$= Kq\left(\frac{1}{x^2(1-\frac{a}{x})^2} - \frac{1}{x^2(1+\frac{a}{x})^2}\right)$

$= \frac{Kq}{x^2}\left(\frac{1}{(1-\frac{a}{x})^2} - \frac{1}{(1+\frac{a}{x})^2}\right)$

$= \frac{Kq}{x^2}\left(\frac{(1+a/x)^2 - (1-a/x)^2}{(1-a/x)^2(1+a/x)^2}\right)$

$= \frac{Kq}{x^2}\left(\frac{1 + 2a/x + a^2/x^2 - (1 - 2a/x + a^2/x^2)}{\{(1+a/x)(1-a/x)\}^2}\right)$

$= \frac{Kq}{x^2} \times \frac{4a/x}{(1^2 - a^2/x^2)^2}$

$\because \frac{a^2}{x^2} \ll\ll 1$ we neglect it

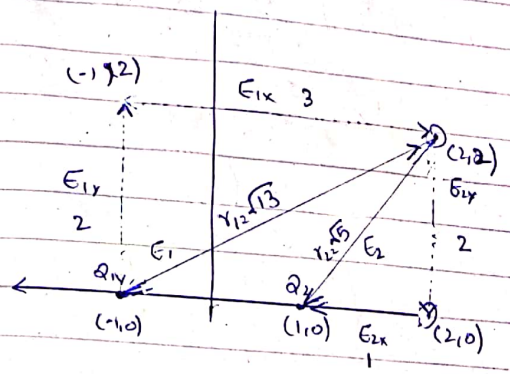
$= \frac{4Kqa}{x^3}$ Ans

Q21

$Q_1 = 20\,\mu C$

$Q_2 = -10\,\mu C$

E at $(2,2) = ?$



~~$E_x = E_{2x} - E_{1x}$~~ $E_x = E_{1x} - E_{2x}$

~~$E_y = E_{2y} - E_{1y}$~~ $E_y = E_{1y} - E_{2y}$

$E_1 = \frac{Kq_1}{r_1^2} = \frac{9 \times 10^9 \times 20 \times 10^{-6}}{13}$

$E_1 = 13846.15\ N/C$

$E_2 = \frac{Kq_2}{r^2} = 1800\ N/C$

For θ_1:

$\theta_1 = \tan^{-1}(2/3)$

$\theta_1 = 33.69°$

FOR θ_2:-

$\theta_2 = \tan^{-1}\left(\frac{2}{1}\right)$

$\theta_2 = 243.43°$

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

$= 13846 \cos(33.69)° - 1800 \cos(243.43)°$

$= 11520.57 + 805.12$

$E_x = 12325.69$ N/C

$E_y = E_{1y} - E_{2y}$

$= 13846 \sin(33.69) - 1800 \sin(243.4$

$E_y = 9290$ N/C