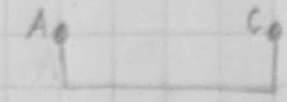
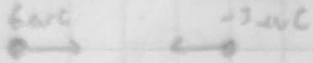
# T3

## P. 1

A y B = 6 μC
C = −12 μC




$$Q_{AC} = \frac{6\mu - 12\mu}{2} = -3\mu C$$



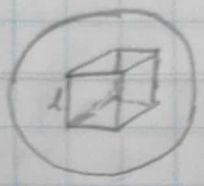

$$F_{BC} = -F_{CB} = \frac{K(6\times10^{-6})(3\times10^{-6})}{(0.015)^2}$$

$F_{BC} = 720$

**$F_{BC} = 720$ N.**

## P. 2

$\rho = 800\ nC/m^3$
$R = 24cm = 0.24m$
$l = 0.06m$



$$\rho = \frac{Q}{\frac{4}{3}\pi l^3}$$

$$\oint E \cdot \vec{A} = \frac{q_{enc}}{\varepsilon_0} \qquad E(6l^2) = \frac{\rho l^3}{\varepsilon_0}$$

$$E = \frac{\rho l}{6\varepsilon_0} = \frac{800n(0.06)}{6(8.85\times10^{-12})} = 903.95$$

**$\Phi = 19.53\ Nm^2/C$**

$$\Phi = EA = (903.95)[6(0.06)^2] = 19.525$$

## P. 3

a) $q = 30\times10^{-3}\ C$ $\quad E_y = 3.5\ N/C$ $\quad t = 0$
$m = 7\times10^{-3}\ kg$ $\quad E_x = E_z = 0$ $\quad V_{0x} = 50\ m/s$
$V_{0y} = V_{0z} = 0$

$$a = \frac{Eq}{m} = \frac{(3.5)(30\times10^{-3})}{7\times10^{-3}} = 15\ m/s^2$$

$V_{fy} = \cancel{V_{0y}}^{0} + at$
$V_{fy} = at \quad (15)$
$V_{fy} = (15)(2) = 30\ m/s$

$$v = \sqrt{30^2 + 50^2} = 58.31\ m/s$$

**$V = 58.3\ m/s$**

b) $Y = \cancel{V_{0y}t}^{0} + \frac{1}{2}at^2 =$

$Y = \frac{1}{2}(15)(2)^2 = 30m$

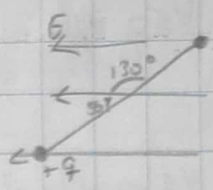
**$Y = 30m.$**

## P. 4

a) $q = 2.5 * 10^{-3}\ C$

$l = 0.06\ m$

$E = 6 * 10^5\ N/C$

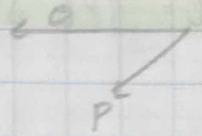



$\tau = pE \operatorname{sen} 50$

$\tau = qlE \operatorname{sen} 50$

$\tau = (2.5 * 10^{-3})(0.06)(6 * 10^5) \operatorname{sen} 50° = 68.94\ Nm.$

b)




$\tau = -k$

$\tau = 68.94\ N \cdot m$

$\tau = -k$

c) $\Delta W = -\Delta U$

$\Delta W = -pE [\cos\theta_f - \cos\theta_0]$

$\Delta W = -pE [\cos 0° - \cos 50°] = (2.5 * 10^{-3})(0.06)(6 * 10^5) \cos 50°$

$\Delta W = -32.15\ J$

$W = -32.15\ J$

## P. 5

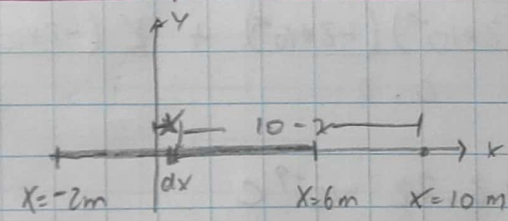
$q = 24\ nC.$

$\lambda = q/l$

$q = \lambda l$

$dq = \lambda dx.$

a) $E = \int \frac{K dq}{r^2}$



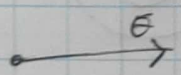

$E = K\lambda \int_{-2}^{6} \frac{dx}{(10-x)^2} = K\lambda \int_{-2}^{6} \frac{dx}{(10-x)^2} = K\lambda \left[ \frac{1}{10-x} \Big|_{-2}^{6} \right]$

$E = 9 * 10^{-9} \left(\frac{24n}{8}\right) \left[\frac{1}{4} - \frac{1}{12}\right] = 4.5\ N/C$

$E = 4.5\ N/C$

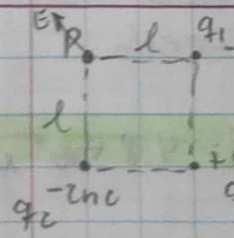
$E = +\hat{\imath}$

b)

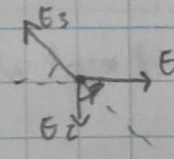


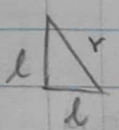

## P. 6.

a)




$l = 0.2m$




$r^2 = l^2 + l^2$ $2l^2$

$r = 0.2\sqrt{2}$

$r = \sqrt{2}/5$

$E_1 = \frac{K(2 * 10^{-9})}{(0.2)^2} = 450\ N/C$

$E_2 = \frac{k(2\times10^{-9})}{(0.2)^2} = 450\ N/C$

$E_3 = \frac{k(4\times10^{-9})}{2(0.2)^2} = 450\ N/C$

$E_R = 131.8\ \hat{i} - 131.8\ \hat{j}$

$|E_R| = \sqrt{(131.8)^2 + (-131.8)^2}$

$|E_R| = 186.39$

$E = 186.39\ N/C$

b) $V = \frac{kq_1}{r_1} + \frac{kq_2}{r_2} + \frac{kq_3}{r_3}$

$V = \frac{k}{0.2}\left(-2(2\times10^{-9}) + \frac{4\times10^{-9}}{\sqrt{2}}\right) = -52.72\ V$

$V = -52.72\ V$

c) $U = \frac{kq_1q_2}{\ell} + \frac{kq_1q_3}{\ell} + \frac{kq_2q_3}{\ell}$

$U = \frac{k(-2\times10^{-9})(-2\times10^{-9})}{0.2} + \frac{k(-2\times10^{-9})(4\times10^{-9})}{0.2} + \frac{k(-2\times10^{-9})(4\times10^{-9})}{0.2}$

$U = -592.72\times10^{-9}\ C$

$U = -592.72\ nJ$

c) $W = (V_f - V_0)q \Rightarrow W = \left[\left(\frac{-kq}{a} - \frac{kq}{a}\right) - \left(\frac{-kq}{q} - \frac{kq}{q}\right)\right] q = 0$

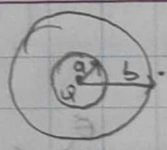
$W = 0.$

P.7

a) $a = 0.05m \quad b = 0.15m \quad \ell = 0.3m$

$Q = +9\mu C \quad q = -25\mu C$

$E = r = 20\ cm$




$\oint E\,dA = \frac{q_{en}}{\varepsilon_0} \Rightarrow E(2\pi r\ell) = \frac{Q-q}{\varepsilon_0} \Rightarrow E = \frac{Q-q}{2\pi r\ell\varepsilon_0} =$

$E = \frac{(9\mu - 25\mu)}{2\pi(0.2)(0.3)\varepsilon_0} = 4.8\times10^6\ N/C$

$E = 4.8\times10^4\ N/C$

b) $E = r = 7\,cm$

$$\oint E \cdot dA = \frac{q_{enc}}{\varepsilon_0}$$

$$E(2\pi r l) = \frac{Q}{\varepsilon_0}$$

$$E = \frac{Q}{2\pi r l \varepsilon_0} = \frac{9 \times 10^{-6}}{(0.07)(0.3)(2\pi\varepsilon_0)} = 7.71\ \frac{kN}{C}$$

$$E = 7.71\ kN/C$$

c) $E = r < 3\,cm$

$$\oint E \cdot dA = \frac{q_{enc}}{\varepsilon_0} \Rightarrow E = \frac{q_{enc}}{2\pi r l \varepsilon_0}$$

$$\frac{\rho_r = \rho_{enc}}{\frac{Q}{V_T} = \frac{q_{enc}}{V_{enc}}}$$

$$E = \frac{3.24\ u}{2\pi(0.03)(0.3)\varepsilon_0} = 6.48\ kN/C$$

$$q_{enc} = \frac{Q V_{enc}}{V_T}$$

$$q_{enc} = 3.24 \times 10^{-6}\,C$$

$$E = 6.48\ kN/C$$