$E_2 = \frac{9\times10^9 \times 2\times10^{-6}}{4^2} = 1125 \frac{N}{C}$

$E_4 = \frac{9\times10^9 \times 4\times10^{-6}}{5^2} = 1440 \frac{N}{C}$

**Q1)** $E_x = E_2 + E_4 \cos\alpha$

$= 1125 + 1440\left(\frac{4}{5}\right) = 2277 \frac{N}{C}$

**Q2)** $E_y = -E_4 \sin\alpha$

$= -1440\left(\frac{3}{5}\right) = -864 \frac{N}{C}$

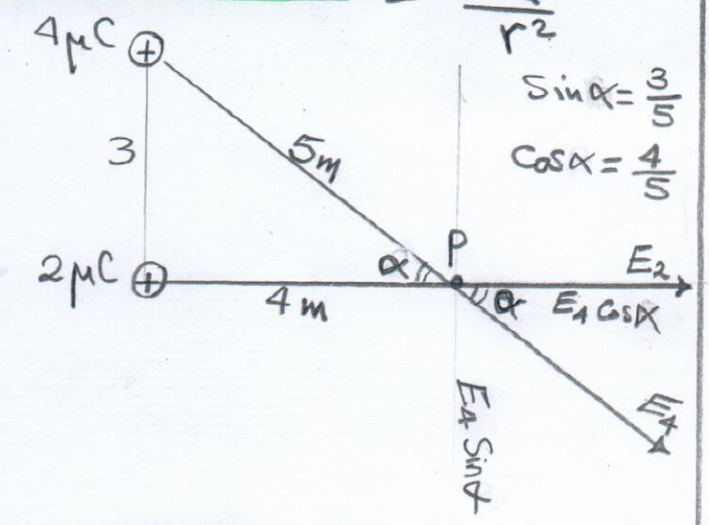
**Q3)** $\theta = \tan^{-1}\frac{E_y}{E_x} = -20.8°$ in 4th Q

$= 339.2$ with +ve x

$E_R = \sqrt{E_x^2 + E_y^2} = 2435 \frac{N}{C}$

1st Mid 2nd 36-37

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




**Q4)** $V = \frac{KQ}{r}$

$V_p = \frac{KQ_2}{r_2} + \frac{KQ_4}{r_4}$

$= \frac{9\times10^9\times2\times10^{-6}}{4} + \frac{9\times10^9\times4\times10^{-6}}{5}$

$= 4500 + 7200$

$= 11700$ Volt

**Q5)** $E = \frac{F}{q} \Rightarrow F = q_e E$

$F = 1.6\times10^{-19} \times 50\times10^6$

$= 8\times10^{-12}$ N

**Q6)** $r_{12} = r_{13} = r_{23} = 4mm = 4\times10^{-3}$ m

$U_t = 675$ J & $Q_1 = Q_2 = Q_3 = Q$

$= 3\frac{KQ_1Q_2}{r_{12}} = \frac{3KQ^2}{r_{12}}$

$Q^2 = \frac{r_{12}U_t}{3K} = 100\times10^{-12}$ C$^2$

$Q = \sqrt{100\times10^{-12}} = 10\times10^{-6}$ C $= 10\mu$C

**Q7)** $V_p = 210$V $<$ $U = q_pV_p = KE = \frac{1}{2}m_pv^2$

$\frac{1}{2}m_pv^2 = q_pV_p$

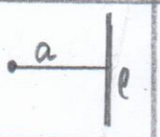
$|v| = \sqrt{\frac{2q_pV_p}{m_p}} = 0.2\times10^6$ m/s

**Q8)** $\Phi_{total} = \frac{Q_{in}}{\varepsilon_0}$


$\Phi_t = \frac{177\times10^{-6}}{8.85\times10^{-12}} = 20\times10^6$

$\Phi_{each\,face} = \frac{20\times10^6}{6\,faces} = 3.3\times10^6$

**Q9)** $E = \frac{2K\lambda}{a}$




**Q10)** $Q = 15\mu C = 15\times10^{-6}$ C

$a = 30\times10^{-2}$ m Insulator

$r = 30\times10^{-2}$ Solid

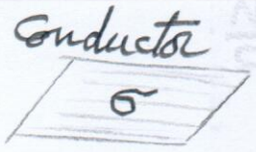
$E_{surface} = \frac{KQ}{r^2} = 1.5\times10^6$ N/C

$= 1.5$ MN/C

**Q11)** $E_{10cm} = E_{inside} = Zero$

Conductor $Q_{in} = 0$

**Q12)** $E = \frac{\sigma}{\varepsilon_0}$




$\sigma = \varepsilon_0 E = 8.85\times10^{-12} \times 130$

$= 1.15\times10^{-9}\ C/m^2$

$= 1.15\ nC/m^2$

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**Q13)** $C_1$ and $C_2$ in parallel

$V_1 = V_2$ & $Q = CV$

$\frac{Q_1}{C_1} = \frac{Q_2}{C_2}$

$Q_2 = \frac{C_2}{C_1} Q_1 = \frac{4\,mF}{2\,mF} \times 4\,\mu C$

$= 8\,\mu C$

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**Q14)** $V = 12V$ & $d = 3.5\times10^{-3}\,m$


Energy Density $u = \frac{1}{2}\varepsilon_0 E^2$

$u = \frac{1}{2}\varepsilon_0 \left(\frac{V}{d}\right)^2$

$= \frac{1}{2}\times 8.85\times10^{-12} \left(\frac{12}{3.5\times10^{-3}}\right)^2$

$= 52\times10^{-6} = 52\ \mu J/m^3$

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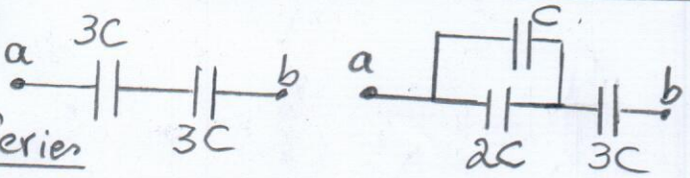
**Q15)**




In Series

$C_t = \frac{3C * 3C}{3C + 3C} = \frac{9C^2}{6C} = 1.5C$

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مع أطيب الأمنيات بالتوفيق

Prof. M.M.Gh.