HW4

1. Solution: Integrate shells of area $4\pi r^2$, $\rho = 4.3r^3$ from $r=0$ to $0.2m$

$$\int_0^{0.2} 4\,(4.3)\,\pi r^4\,dr = 3.46\times10^{-3}\,C$$

2. Solution:

$$\int \vec{E}\cdot d\vec{a} = \frac{1}{\varepsilon_0}\int \rho_v\,dv = \frac{1}{\varepsilon_0}\int 0.005r\,dv$$

$$2\pi r h E = \frac{0.005}{\varepsilon_0}\int_0^h\int_0^{2\pi}\int_0^r r^2\,dr\,d\theta\,dz$$

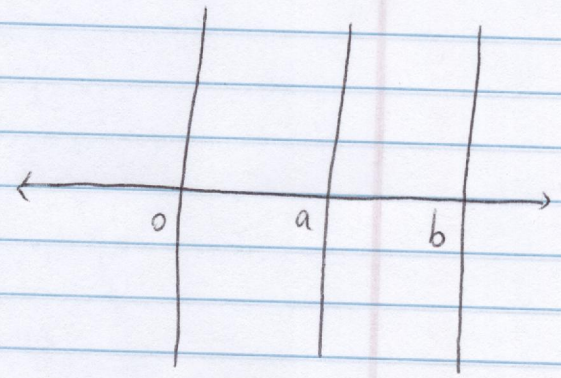
$$= \frac{0.005}{\varepsilon_0}\cdot h\cdot 2\pi\cdot\frac{r^3}{3}\cdot\vec{r}$$

$$\Rightarrow E = \frac{0.005r^2}{\varepsilon_0\cdot 3}\vec{r} = \frac{0.00167}{\varepsilon_0}r^2\cdot\vec{r}$$

Surface is a cylinder, field is radial.

3. Solution:

$$E(x) = \begin{cases} \dfrac{-(\rho_{s1}+\rho_{s2}+\rho_{s3})}{2\varepsilon_0} & x<0 \\ \dfrac{-(-\rho_{s1}+\rho_{s2}+\rho_{s3})}{2\varepsilon_0} & 0<x<a \\ \dfrac{\rho_{s1}+\rho_{s2}-\rho_{s3}}{2\varepsilon_0} & a<x<b \\ \dfrac{\rho_{s1}+\rho_{s2}+\rho_{s3}}{2\varepsilon_0} & x>b \end{cases}$$



4.