Gauss' law

$\boxed{1}$

(a) $E = \frac{1}{4\pi\epsilon_0}\frac{Q}{r^2}$ $Q = +92e$ (92 protons)

(b) use the above

(c) No charge enclosed.

$\boxed{2}$ (a) $\vec{E}\cdot\hat{n}_2$ (parallel) $\vec{E}\cdot\hat{n}_1$ (anti-parallel)

(b) $\vec{E}\cdot\hat{n}_1 = En_1 \cos\theta$

$\boxed{3}$ $\phi_E = \oint \vec{E}\cdot d\vec{A} = \frac{q}{\epsilon_0}$

$\boxed{4}$ $\rightarrow$ use Gauss law

$\boxed{5}$

$\boxed{6}$ Flux, $\phi = \vec{E}\cdot\vec{A}$ $|A| = (0.22)(0.28)\,m^2$

$= EA\cos\theta$ $|E| = 28\times10^3$ N/C

$\theta = 0^\circ$, $\theta = 30^\circ$, $\theta = 90^\circ$

$\boxed{7}$ $|A| = 4\,m^2$ $\phi = EA$

$\boxed{8}$, $\boxed{9}$ please ~~ty~~ try yourself.

$\boxed{10}$ $E = \frac{2\sigma_1}{\epsilon_0}$

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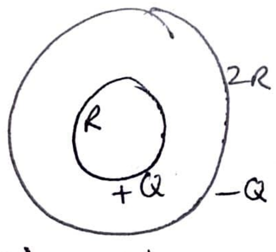

(i) $\phi_E = \oint \vec{E} \cdot d\vec{A} = \dfrac{Q_{enclosed}}{\epsilon_0}$

$\phi_E = \dfrac{+Q}{\epsilon_0} \quad [R < r < 2R]$

(ii) $\phi_E = 0 \quad [r < R]$

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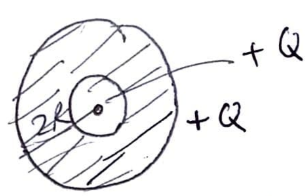

Since conducting, all the charges are at the outer surface, thus, $+Q + Q \to 2Q$

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$Q(r) = \int_0^r \rho \, dv = \frac{4}{3}\pi r^3 \rho$

Ratio, $\dfrac{Q(r)}{Q} = \left(\dfrac{r}{R}\right)^3$ total charge, $Q = \left[\frac{4}{3}\pi R^3\right]\rho$

for, ~~r~~ $r = \dfrac{R}{2}$ charge ratio $\simeq \dfrac{1}{8}$

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$\rho(r) = ar$ thus, $Q(r) = \int_0^R \rho(r)\, dv$

$= \int_0^R ar \, 4\pi r^2 \, dr$

$Q = \pi a R^4$

$\boxed{15}$ surface charge density, ~~$\sigma = \epsilon_0 E$~~

(a) $\sigma = \epsilon_0 E \qquad E = -150\ N/C$

$= -1.33 nC/m^2$

(b) $R_E = 6.38 \times 10^6 m$

Then total charge, $Q = 4\pi R_E^2 \sigma$

$= 4\pi R_E^2 (\epsilon_0 E)$

$= -680\ kC$.