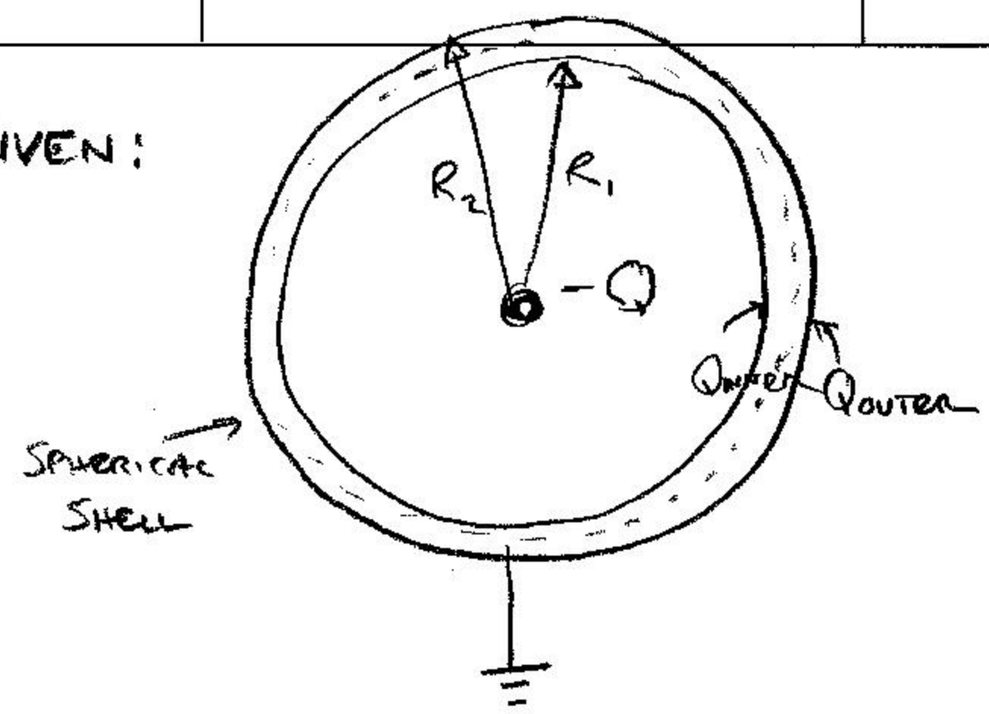
22-10 GIVEN:



FIND: Q_{INNER}, Q_{OUTER}

$R_1 < r < R_2$, $\oint \vec{E} \cdot \hat{n}\, dA = \frac{q_{IN}}{\epsilon_0} = 0 = \frac{-Q + Q_{INNER}}{\epsilon_0} \Rightarrow Q_{INNER} = Q$

BECAUSE OF GROUND, $Q_{OUTER} = 0 \Rightarrow$ (b) IS TRUE

22-63 GIVEN: POINT CHARGE/SHELL ABOVE $Q = +2.5\mu C$ $Q_{SHELL} = 0$ (REPEAT $Q_{SHELL} = 3.5\mu C$)
$R_1 = 60cm$, $R_2 = 90cm$

FIND: σ_{INNER}, σ_{OUTER}, $E(r)$

(a) AS ABOVE $Q_{INNER} = -Q \Rightarrow \sigma_{INNER} = \frac{-2.5\mu C}{4\pi(.6m)^2} = \boxed{-5.5\times10^{-7}\frac{C}{m^2}}$

$Q_{SHELL} = Q_{INNER} + Q_{OUTER} = 0 \Rightarrow Q_{OUTER} = 2.5\mu C$

$\sigma_{OUTER} = \frac{2.5\mu C}{4\pi(.9m)^2} = \boxed{2.5\times10^{-7}\frac{C}{m^2}}$

(b) $r < R_1$ $E = \frac{kQ}{r^2} = \frac{9\times10^9\frac{N\text{-}m^2}{C^2}(2.5\mu C)}{r^2} = \boxed{\frac{2.25\times10^4\frac{N\text{-}m^2}{C}}{r^2}}$

$R_1 < r < R_2$ $E = \boxed{0}$

$r > R_2$ $E = \boxed{\frac{2.25\times10^4\frac{N\text{-}m^2}{C}}{r^2}}$

(c) $\sigma_{INNER} = \boxed{-5.5\times10^{-7}\frac{C}{m^2}}$ $(Q_{INNER} = -2.5\mu C)$

$Q_{SHELL} = Q_{INNER} + Q_{OUTER} = 3.5\mu C \Rightarrow Q_{OUTER} = 2.5\mu C + 3.5\mu C = 6\mu C$

$\sigma_{OUTER} = \frac{6\mu C}{4\pi(.9m)^2} = \boxed{5.9\times10^{-7}\frac{C}{m^2}}$

$r < R_1$ $E = \boxed{\frac{2.25\times10^4\frac{N\text{-}m^2}{C}}{r^2}}$

$R_1 < r < R_2$ $E = \boxed{0}$

$r > R_2$ $E = \frac{kQ_{OUTER}}{r^2} = \frac{(9\times10^9\frac{N\text{-}m^2}{C^2})(6\mu C)}{r^2} = \boxed{\frac{5.4\times10^4\frac{N\text{-}m^2}{C}}{r^2}}$

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