Mean: 15.34
STD DEV: 7.36
Sample: 65

Physics 172
Summer Quarter 1983
August 5, 1983
George Williams

SECOND MIDTERM

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Discussion Instructor (CIRCLE ONE): Arnold Campbell Schoenborn

Discussion Section # 3

Report all numbers to the proper number of significant figures!
Use the conversion constants given on the front page.

A cylindrically symmetric charge distribution in a nonconductor is described by the relation

$$\rho = \frac{A}{R^3} \quad \text{for } R_1 < R < R_2$$

and is zero everywhere else. (A is a constant.)

(a) Find the total charge on a length L of the cylinder.
(b) Find the electric field at a point P, where P is betweeen R_1 and R_2.

13 pts a) $Q = \int \rho \, dv$; $\rho = \frac{A}{r^3}$; $dv = 2\pi r \ell \, dr$

$$Q = \int_{R_1}^{R_2} \frac{A}{r^3} 2\pi r \ell \, dr = 2\pi \ell A \int_{R_1}^{R_2} \frac{dr}{r^2} = -2\pi \ell A \left(\frac{1}{R_2} - \frac{1}{R_1}\right) = 2\pi \ell A \left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

12 pts. b) $\int \vec{E} \cdot d\vec{S} = q/\epsilon_0$; $q = 2\pi \ell A \left(\frac{1}{R_1} - \frac{1}{r}\right)$ from a

E is normal + constant if a cylidrical Gausian surface is chosen;

$ES = \frac{2\pi \ell A}{\epsilon_0}\left(\frac{1}{R_1} - \frac{1}{r}\right)$ $\quad S = 2\pi r \ell$

$E \, 2\pi r \ell = \frac{2\pi \ell A}{\epsilon_0}\left(\frac{1}{R_1} - \frac{1}{r}\right)$

$$E = \frac{A}{\epsilon_0 r}\left(\frac{1}{R_1} - \frac{1}{r}\right)$$

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