Physics 172
Winter Quarter 1986
March 17, 1986
George Williams

19.7 avg

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FINAL EXAM

Name (Print) ROTHMAN Name (Signed)

Discussion Instructor (Circle One): Brown Chung Pollard Rothman

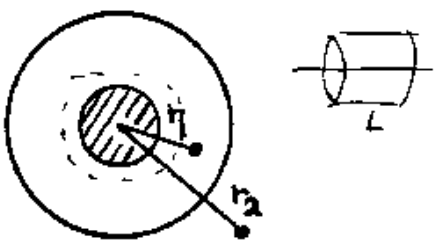
Discussion Section #:_____ Schweizer Soderberg Vaseghi Viohl

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

A metal rod is placed inside a metal cylinder shown in the cross section. Both are very long. The inner rod is given a charge of $+39.2 \times 10^{-6}$ C/m. $= \lambda_1$ The outer cylinder is given a charge of -67.2×10^{-6} C/m. The inner rod has a radius of 0.327 cm, and the outer cylinder, which is thin, has a radius of 3.75 cm.

15 (a) Calculate the electric field, magnitude and direction at $r_1 = 0.625$ cm.

15 (b) Calculate the electric field, magnitude and direction at $r_2 = 4.25$ cm.



$$\int E \cdot da = \frac{Q}{\epsilon_0} \Rightarrow E 2\pi r L = \frac{Q_{enc}}{\epsilon_0}$$

a) $|E| 2\pi r_1 \cancel{L} = \frac{\cancel{L}\,\lambda_1}{\epsilon_0} \Rightarrow |E| = \frac{\lambda_1}{2\pi r_1 \epsilon_0}$ $r_1 = 6.25 \times 10^{-3}$ m

$$\Rightarrow E_1 = \frac{+39.2\times10^{-6}\ \text{C/m}}{2\pi\left[6.25\times10^{-3}\ \text{m}\right]\left[8.85\times10^{-12}\ \text{F/m}\right]} = 1.13\times10^{8}\ \frac{\text{C}}{\text{F m}}$$

$F \equiv \frac{C}{V}$

$= \boxed{+1.13\times10^{8}\ \text{V/m}}$

Radially outward

$$E_2 = \frac{\lambda_1 + \lambda_2}{2\pi r_2 \epsilon_0} = \frac{39.2\times10^{-6} - 67.2\times10^{-6}}{2\pi(4.25\times10^{-2}\ \text{m})(8.85\times10^{-12}\ \text{F/m})}$$

$$\Rightarrow \boxed{E_2 = -1.18\times10^{7}\ \text{V/m}}$$ i.e. Radially inward