

FIRST MIDTERM

Name (Print) ROTHMAN Name (Signed) AVG 13.3

Discussion Instructor (Circle One): Brown Chung Pollard Rothman

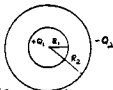
Discussion Section #: _____ Schweizer Soderberg Vaseghi Viohl

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

A uniformly charged sphere of a non-conductor has radius R_1 , and charge Q_1 . It is enclosed in a concentric thin metal spherical shell whose radius is R_2 . ($R_2 > R_1$). The metal shell has total charge Q_2 .

- (a) Calculate the electric field a distance 37.0 cm from the common center of the two spheres. (Numerical answer including sign.)
 (b) Calculate the electric field a distance of 17.5 cm from the common center. (Numerical answer including sign.)
 (c) Calculate the electric field a distance 2.00 cm from the common center. (Numerical answer including sign.)

- $Q_1 = +175 \mu\text{C}$
 $Q_2 = -325 \mu\text{C}$
 $R_1 = 10.0 \text{ cm}$
 $R_2 = 25.0 \text{ cm}$



$$a) |\vec{E}| = \frac{kQ_1}{r^2} + \frac{kQ_2}{r^2} = \frac{9.00 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2}{(0.37)^2} [1.75 \times 10^{-4} \text{ C} - 3.25 \times 10^{-4} \text{ C}]$$

$$= \boxed{-9.86 \times 10^6 \text{ N/C}}$$

$$b) |\vec{E}| = \frac{kQ_1}{r^2} = \frac{[9.00 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2][1.75 \times 10^{-4} \text{ C}]}{[0.175 \text{ m}]^2} = \boxed{+5.14 \times 10^7 \text{ N/C}}$$

$$c) |\vec{E}| = \frac{k[\text{charge enclosed}]}{r^2} = k \left[\frac{Q_1}{\frac{4}{3}\pi(0.1)^3} \right] \left[\frac{1}{3} \pi r^3 \right]$$

$$= [9.00 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2] [1.75 \times 10^{-4} \text{ C}] [2 \times 10^{-2} \text{ m}] = \boxed{3.15 \times 10^7 \text{ N/C}}$$