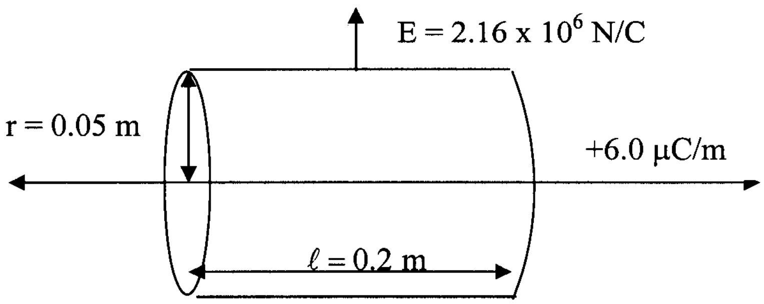
Name________________ SP212 CDR Tucholski

Section 5522 January 2002

1. A very long continuous line of charge has a linear charge density, $\lambda = 6\ \mu C/m$. This charge results in an electric field of 2.16×10^6 N/C at a distance 0.05 m from the line.



I drew a closed Gaussian cylinder is oriented symmetrically with the line charge as shown. The cylinder has radius = 0.05 m and length = 0.20 m.

a. How much charge is enclosed by the gaussian cylinder? (2 points)

$q_{in} = \lambda \ell = (6\ \mu C/m)(.2\ m) = 1.2\ \mu C$

b. What is the flux leaving the gaussian cylinder due to this charge? (2 points)

$\Phi = \frac{q_{in}}{\epsilon_0} = \frac{1.2\ \mu C}{8.85 \times 10^{-12} \frac{C^2}{N \cdot m^2}} = 1.36 \times 10^5\ \frac{N}{C} m^2$

c. Evaluate the integral $\oint \vec{E} \cdot d\vec{A}$ for the cylinder. I broke the integral up into three parts. What is the result for each? How does the sum of these three parts compare to your answer for b. above? (6 points)

$\int_{\text{Left End}} \vec{E} \cdot d\vec{A} = 0$

SAME RESULT

$\int_{\text{Right End}} \vec{E} \cdot d\vec{A} = 0$

$\int_{\text{Curved Side}} \vec{E} \cdot d\vec{A} = EA = (2.16 \times 10^6\ \frac{N}{C})(2\pi)(.05\ m)(.2\ m) = 1.36 \times 10^5\ \frac{N}{C} m^2$

$\oint \vec{E} \cdot d\vec{A} = 0 + 0 + 1.36 \times 10^5\ \frac{N}{C} m^2$

Possibly useful information:

$k = 9 \times 10^9\ N\text{-}m^2/C^2$

$\Phi_E = \oint \vec{E} \cdot d\vec{A} = \frac{Q_{encl}}{\varepsilon_o}$

$\varepsilon_o = 8.85 \times 10^{-12}\ C^2/N\text{-}m^2$

$e = 1.6 \times 10^{-19}$ C

Extra Credit: Many think WWII officially started when Hitler invaded a city in Poland in September 1939. What was the name of that city then, and what is the name of that city today? (you must get both correct)