Recitation 3

Tuesday, September 22, 2020 2:46 PM

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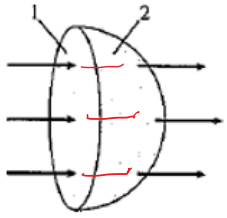
Problem 1: Is the electric flux **1** through the circle larger than, smaller than, or equal to the electric flux **2** through the hemisphere? Explain.



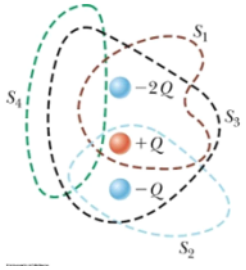
$|E||A|\cos(\theta) = q_{enc}/\varepsilon_0$

$|\vec{E}| = q_{enc}/\varepsilon_0 |A|$

Nothing changes

so $E_1 = E_2$ $E(r) = \frac{Q}{4\pi r^2 \varepsilon_0}$ $E(r) = \frac{\mu Q}{r^2}$

Problem 2: Four closed surfaces, S_1 ***thru*** S_4 together with the charges **-2Q, Q**, and **–Q** are in the figure. Find the electric flux through each surface.



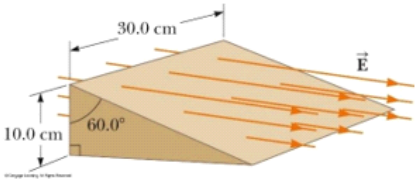
$\Phi_E = q_{enc}/\varepsilon_0$

$\varepsilon_0 = 8.854 \times 10^{-12}$ F/m

Problem 3: Consider a closed triangular box resting within a horizontal electric field of magnitude $E = 7.80 \times 10^4\ ^N/_C$ as shown in the figure. Calculate the electric flux through

a) The vertical rectangular surface

b) The slanted surface of the box



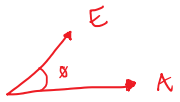
or.) $|E||A|\cos(180)$

$7.8 \times 10^4 (.1)(.3)(-1)$

$= -2340$

$\Phi_E = E \cdot dA$

$|E||A|\cos(\theta)$



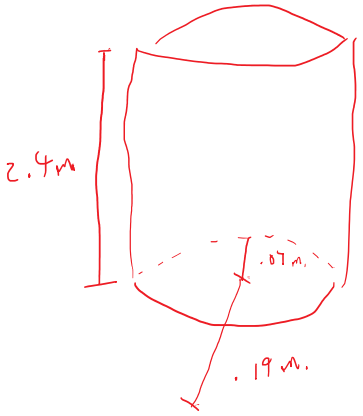
b.) 2340

Problem 4: A cylindrical shell of radius **7.00 cm** and length **2.40 m** has its charge uniformly distributed on its curved surface. The magnitude of the electric field at a point **19.0 cm** radially outward from its axis (measured from the midpoint of the shell) is **36.0 kN/C**. find

a) the net charge on the shell

b) the electric field at a point **4.00 cm** from the axis, measured radially outward from the midpoint of the shell.

a.)



$A = 2\pi r l + 2\pi r^2$

$E = \frac{q}{(2\pi r l + 2\pi r^2)\varepsilon_0}$

$36.0 = \frac{q}{k\varepsilon_0}$

$72\pi r l + 72\pi r^2 = \frac{q}{\varepsilon_0}$

$72\pi r \varepsilon_0 (l + r) = q$

$72\pi (.19)\varepsilon_0 (2.59) = q$

$q = 9.86 \times 10^{-10}\ C$

b.) $E = \frac{9.86 \times 10^{-10}}{2\pi r \varepsilon_0 (l+r)}$

$E = \frac{9.86 \times 10^{-10}}{.08\pi \varepsilon_0 (2.44)}$

$E = 181.6\ kN/C$

Problem 5: A charge of **170μC** is at the center of a cube of edge **80.0cm**. No other charges are nearby.

a. Find the flux through the whole **surface** of the cube.

b. Find the flux through each **face** of the cube.

c. Would your answer for part a. or part b. change if the charge were not at the center?

a.) $\Phi_E = \frac{q}{\varepsilon_0}$

$.64\,\epsilon_0$

$\Phi_E = 30.9\ \mu N/C$

b.) $\Phi_E = 30.9\ \mu N/C$

c.) No, because the surface area would be the same.

Problem 6: A solid sphere of radius **40.0cm** has a total positive charge of **26.0 μC** uniformly distributed throughout its volume. Calculate the magnitude of electric field

a. **0 cm** from the center of the sphere.
b. **10.0cm** from the center of the sphere.
c. **40.0cm** from the center of the sphere.
d. 60.0cm from the center of the sphere