Recitation 5

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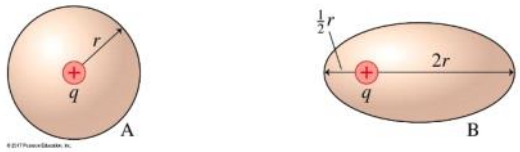
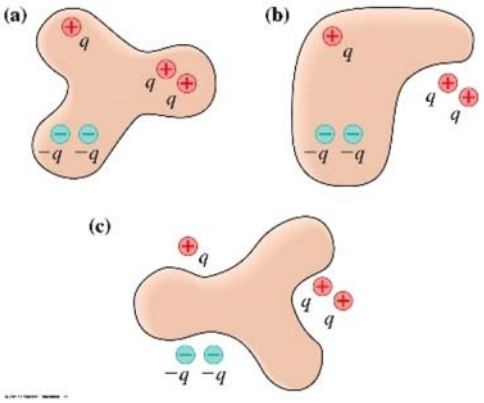
1. The sphere and the ellipsoid in the figure surround equal charges. Four students are discussing the situation.
   Student 1: the fluxes through A and B are equal because the average radius is the same.
   Student 2: I agree that the fluxes are equal, but that is because the enclose equal charges.
   Student 3: the electric field is not perpendicular to the surface for B, and that makes the flux through B less than that of A.
   Student 4: I do not think that Gauss's law even applies to a situation like B, so we cannot compare the fluxes through A and B.
   Which of these students, if any, do you agree with? Explain.

Equal Charges



2. What is the flux through each of the surfaces in the figure? Give your answers in terms of $\frac{q}{\epsilon_0}$.

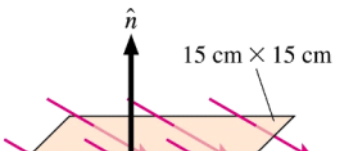


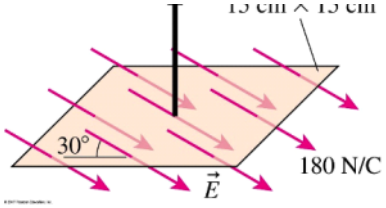
A. $\frac{q}{\epsilon_0}$

B. $-\frac{q}{\epsilon_0}$

C. 0

3. What is the electric flux through the surface shown in the figure?



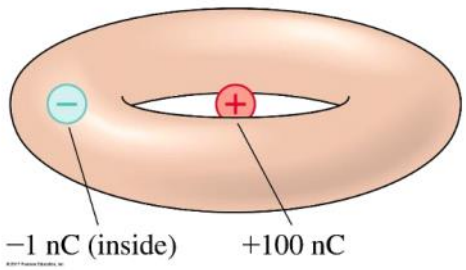


$$-|E||A|\cos(\theta)$$

$$-(180)(.0225)\cos(60)$$

$$= -2.025 \frac{N \cdot m^2}{C}$$

4. What is the net flux through the torus in the figure?



Closed surface

$$E = \frac{q}{\varepsilon_0} = \frac{-(1\times10^{-9})}{(8.85\times10^{-12})}$$

$$= -112.99 \frac{N \cdot m^2}{C}$$

5. 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.

$$E = \frac{kq}{r^2}$$

d. **60.0cm** from the center of the sphere.

$\frac{q}{\varepsilon_0 A}$

$\frac{k\,q\,r}{R^3}$

A.) No electric flux

B.) $\frac{k(26\times10^{-6})(.10)}{(.40)^3}$

$= 3.65\times10^5$

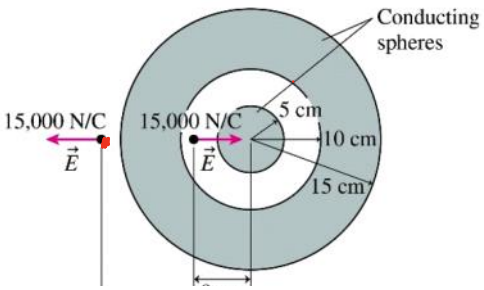
C.) $\frac{k(26\times10^{-6})}{(.40)^2}$

$= 1.46\times10^6$

D.) $\frac{k(26\times10^{-6})}{(.60^2)}$

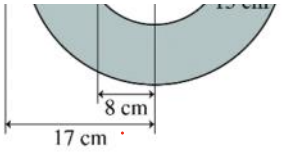
$= 6.5\times10^5$

6. The figure shows a solid metal sphere at the center of a hollow metal sphere. What is the total charge on:
   a. The exterior of the inner sphere?
   b. The inside surface of the hollow sphere?
   c. The exterior surface of the sphere?



A.) $\frac{Er^2}{k} = q$

$\frac{(15,000)(.08)^2}{}$



$$\frac{(15{,}000)(.17)}{(8.99\times10^{9})}$$

$$= 1.07\times10^{-8}\ C$$

B.) Equal charge, opposite sign.

$$-1.07\times10^{-8}\ C$$

C.) $$\frac{(15{,}000)(.17)^{2}}{(8.99\times10^{9})}$$

$$= 4.82\times10^{-8}\ C$$