What is the total charge for this distribution?

$$\rho(\mathbf{r}) = \sum_{k=0}^{2} (1+k)\, q\, \delta^3(\mathbf{r} - k\mathbf{a})$$

A. q

B. 2 q

C. 4 q

D. 6 q

E. Something else

ANNOUNCEMENTS

- Exam 1 is coming up! October 2nd (More details next week!)
- And I will post practice exams to Slack!

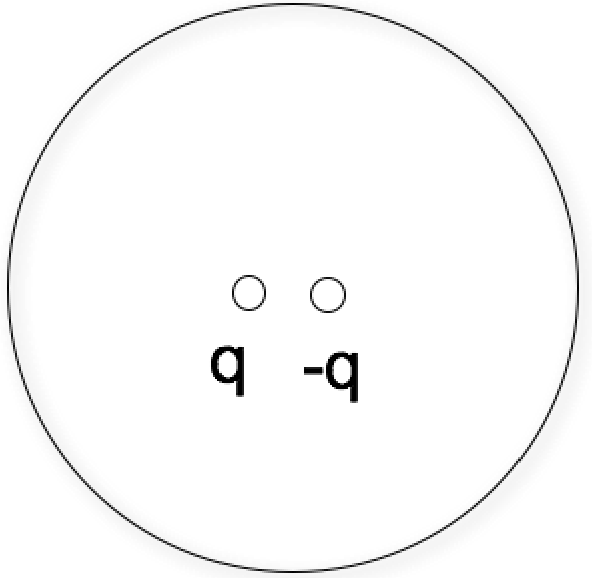
A Gaussian surface which is *not* a sphere has a single charge (q) inside it, *not* at the center. There are more charges outside. What can we say about total electric flux through this surface $\oint_S \mathbf{E} \cdot d\mathbf{A}$?

A. It is q/ε_0.
B. We know what it is, but it is NOT q/ε_0.
C. Need more info/details to figure it out.

A Gaussian surface which is *not* a sphere has a single charge (q) inside it, *not* at the center. There are more charges outside. Can we use Gauss's Law ($\oint_S \mathbf{E} \cdot d\mathbf{A}$) to find $|\mathbf{E}|$?

A. Yes
B. No
C. Maybe?

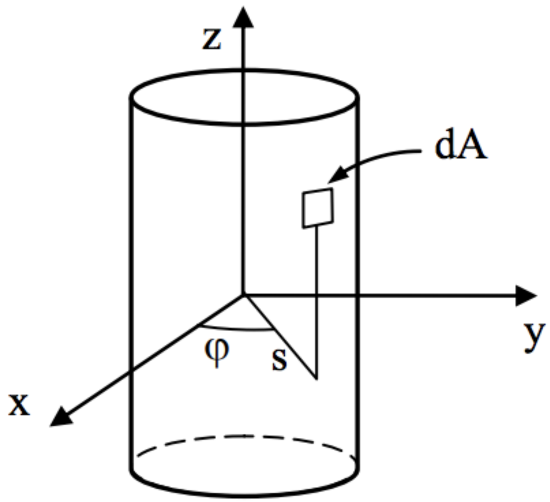
An electric dipole ($+q$ and $-q$, small distance d apart) sits centered in a Gaussian sphere.



What can you say about the flux of $\mathbf{E}$ through the sphere, and $|\mathbf{E}|$ on the sphere?

A. Flux = 0, E = 0 everywhere on sphere surface
B. Flux = 0, E need not be zero *everywhere* on sphere
C. Flux is not zero, E = 0 everywhere on sphere
D. Flux is not zero, E need not be zero...

SLAC (Stanford Linear Accelerator Center) is where quarks (including the charm quark), and the tauon (like a heavier electron) were discovered.



One afternoon, the beam line is struck by lightning, which gives it a uniform surface charge density $+\sigma$. Does that affect the experiment?!

What is the infinitesimal area, dA, of a small patch on a cylindrical shell centered on the z-axis?

A. $d\phi\, dz$
B. $s\, d\phi\, dz$
C. $s\, ds\, d\phi$
D. $ds\, dz$
E. Something else

Which way does the electric field due to the positive charges resting on the beam line point for locations *outside the pipe* far from the ends?

A. Roughly radially outward
B. Exactly radially outward
C. Roughly radially inward
D. Exactly radially inward
E. It varies too much to tell

Which way does the electric field due to the positive charges resting on the beam line point for locations *inside the pipe* far from the ends?

A. Exactly radially outward
B. Exactly radially inward
C. It varies too much to tell
D. Something else

Consider a spherical Gaussian surface. What is the $d\mathbf{A}$ in $\int\int \mathbf{E} \cdot d\mathbf{A}$?

A. $r d\theta d\phi \hat{r}$

B. $r^2 d\theta d\phi \hat{r}$

C. $r \sin\theta d\theta d\phi \hat{r}$

D. $r^2 \sin\theta d\theta d\phi \hat{r}$

E. Something else

Consider an infinite sheet of charge with uniform surface charge density $+\sigma$ lying in the $x-y$ plane. From symmetry arguments, we can argue that $\mathbf{E}(x, y, z)$ can be simplified to:

A. $\mathbf{E}(x, y)$; direction undetermined
B. $E_z(x, y)$
C. $\mathbf{E}(z)$; direction undetermined
D. $E_z(z)$
E. Something else

We derived that the electric field due to an infinite sheet with charge density σ was as follows:

$$\mathbf{E}(z) = \begin{cases} \dfrac{\sigma}{2\varepsilon_0}\hat{k} & \text{if} \quad \mathrm{z} > 0 \\ \dfrac{-\sigma}{2\varepsilon_0}\hat{k} & \text{if} \quad \mathrm{z} < 0 \end{cases}$$

What does that tell you about the difference in the field when we cross the sheet, $\mathbf{E}(+z) - \mathbf{E}(-z)$?

A. it's zero

B. it's σ/ε_0

C. it's -σ/ε_0

D. it's +$\sigma/\varepsilon_0\hat{k}$

E. it's -$\sigma/\varepsilon_0\hat{k}$