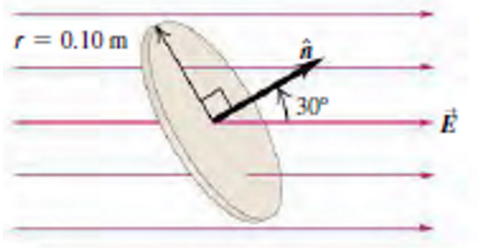
Flux through a disk

Friday, 29 January, 2021 20:47

A disk of radius $0.1\,m$ is oriented with its normal unit vector $\hat{n}$ at 30° to a uniform electric field $\vec{E}$ of magnitude $2 \times 10^3\ N/C$.

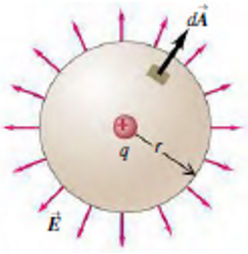


- What is the electric flux through the disk?
- What is the flux through the disk if it is turned so that $\hat{n}$ is perpendicular to $\vec{E}$?
- What is the flux through the disk if $\hat{n}$ is parallel to $\vec{E}$?

Flux through a sphere

Friday, 29 January, 2021 20:48

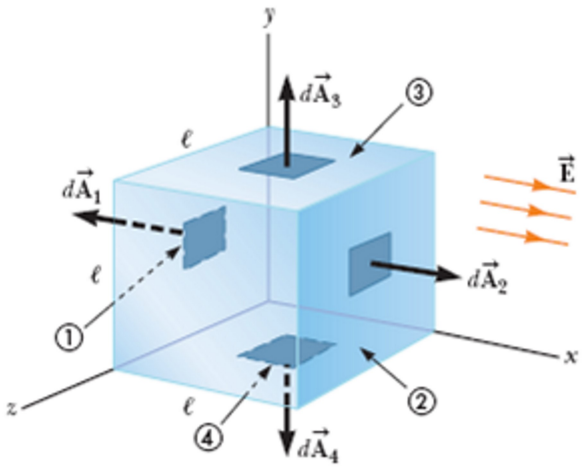
A point charge $q = +3\,\mu C$ is surrounded by an imaginary sphere of radius $r = 0.2\,m$ centered on the charge. Find the resulting electric flux through the sphere.



Flux through a cube

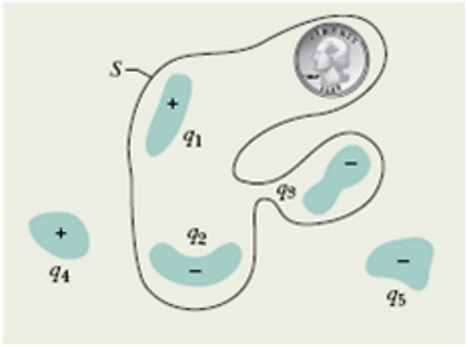
Friday, 29 January, 2021 20:49

Consider a uniform electric field **E** oriented in the positive x direction in empty space. A cube of edge length ℓ is placed in the field, oriented as shown. Find the net electric flux through the surface of the cube.



Relating the net enclosed charge and the net flux

Friday, 29 January, 2021 20:49

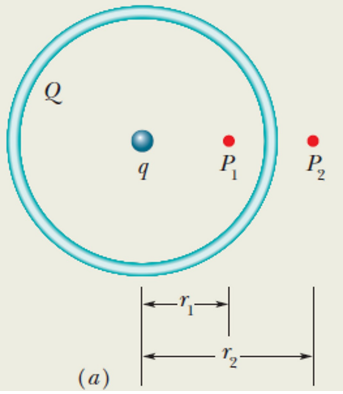


The figure shows five charged lumps of plastic and an electrically neutral coin. The cross section of a Gaussian surface S is indicated. What is the net electric flux through the surface if $q_1 = q_4 = 3.1\,nC$, $q_2 = q_5 = -5.9\,nC$ and $q_3 = -3.1\,nC$?

Using Gauss' law to find the electric field

Friday, 29 January, 2021 20:49

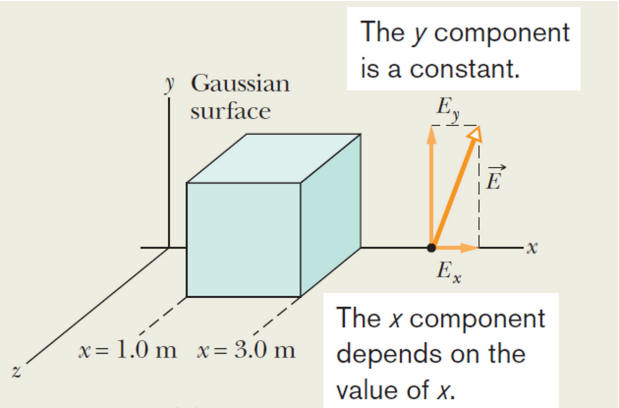
The figure shows a plastic spherical shell with uniform charge $Q = -16e$ and radius $R = 10\,cm$. A particle with charge $q = +5e$ is at the center. What is the electric field at (a) point P_1 at radial distance $r_1 = 6\,cm$ and (b) point P_2 at radial distance $r_2 = 12\,cm$?



Flux through a closed cube, nonuniform field

Friday, 29 January, 2021 20:50

A nonuniform electric field given by $\vec{E} = (3x\hat{\imath} + 4\hat{\jmath})\ N/C$ pierces the Gaussian cube shown in the figure. (x is in meters.)



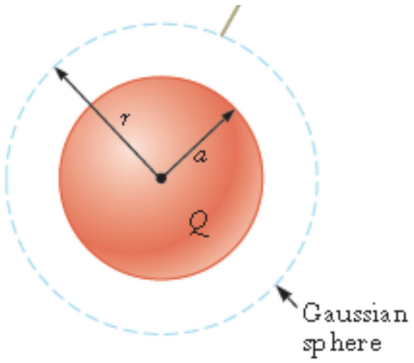
- What is the electric flux through the right face, the left face, and the top face?
- What is the net charge enclosed by the Gaussian cube?

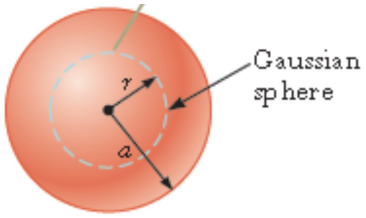
A Spherically Symmetric Charge Distribution

Monday, 1 February, 2021 16:31

An insulating solid sphere of radius a has a uniform volume charge density ρ and carries a total positive charge Q.

- Calculate the magnitude of the electric field at a point outside the sphere.
- Find the magnitude of the electric field at a point inside the sphere.





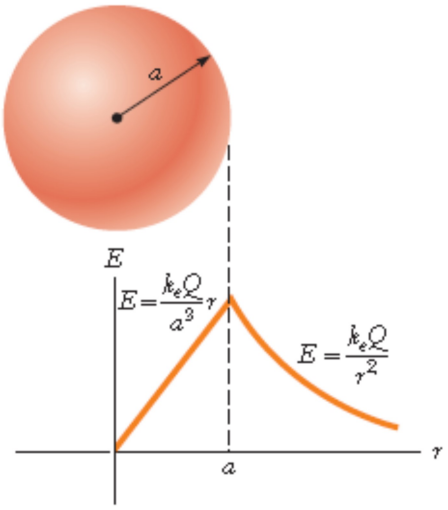
Answers:

When $r > a$:

$$E = \frac{k_e Q}{r^2}$$

When $r < 0$:

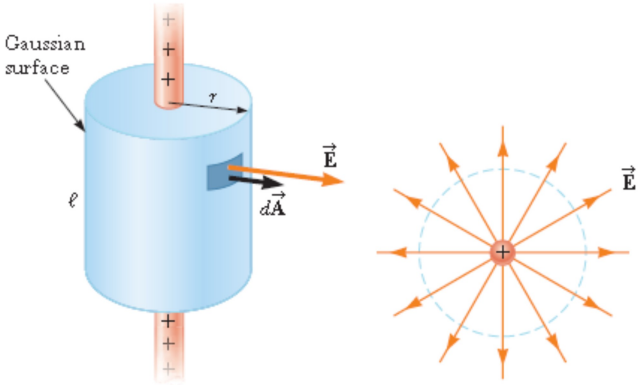
$$E = \frac{k_e Q}{a^3} r = \frac{\rho}{3\epsilon_o} r$$



A Cylindrically Symmetric Charge Distribution

Monday, 1 February, 2021 16:35

Find the electric field a distance r from a line of positive charge of infinite length and constant charge per unit length λ.



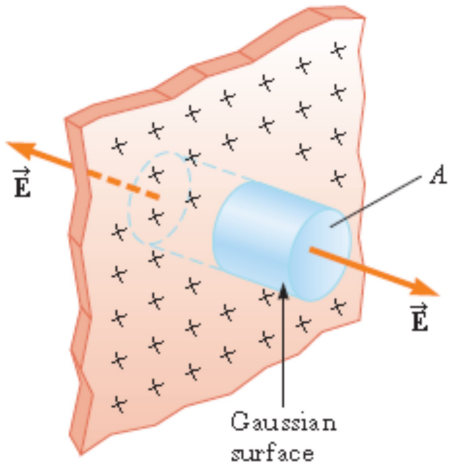
Answer:

$$E = \frac{2k_e\lambda}{r}$$

A Plane of Charge

Monday, 1 February, 2021 20:11

Find the electric field due to an infinite plane of positive charge with uniform surface charge density σ.



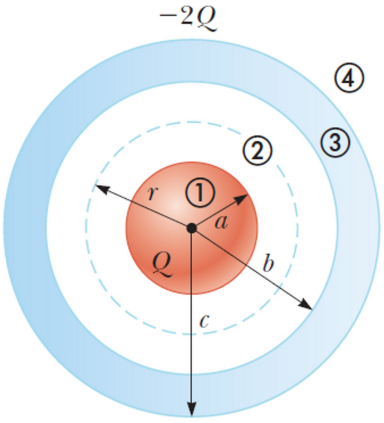
Answer:

$$E = \frac{\sigma}{2\epsilon_o}$$

A Sphere Inside a Spherical Shell

Friday, 29 January, 2021 20:50

A solid insulating sphere of radius (a) carries a net positive charge (Q) uniformly distributed throughout its volume. A conducting spherical shell of inner radius (b) and outer radius (c) is concentric with the solid sphere and carries a net charge (-2Q).



- find the electric field in the regions labeled: 1, 2, 3 and 4 in the Figure, and
- the charge distribution on the shell when the entire system is in electrostatic equilibrium.