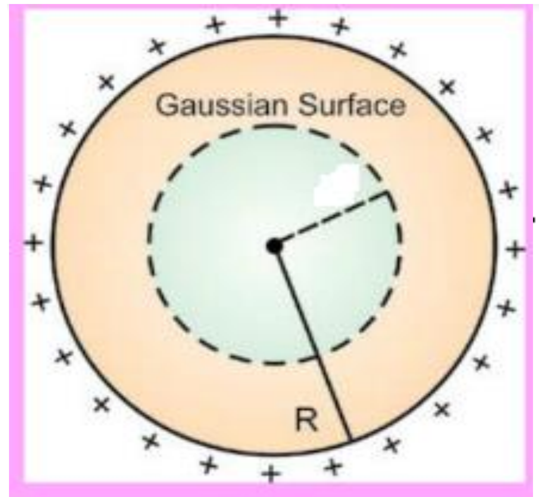
A Charge Isolated Conductor



"An excess charge on an isolated conductor is located entirely on the outer sphere of the conductor."

The electric intensity inside the conductor must be zero. Suppose a hollow conducting sphere of radius r. We place a Gaussian surface inside hollow charged sphere.

Applying Gauss law,

$\Phi_E = \frac{q}{\epsilon o}$

We know q = 0 inside Gaussian surface.

$\Phi_E = \frac{0}{\epsilon o}$

Also $\Phi_E = \bar{E}.\bar{A}$

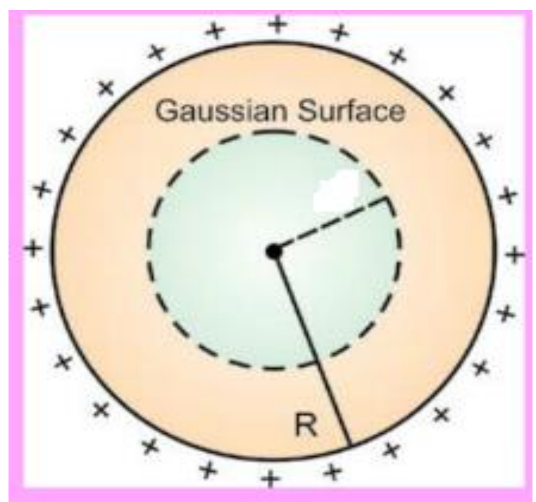
$\bar{E}.\bar{A} = 0$

$\bar{A} \neq 0, \bar{E} = 0$

Result:

Thus any apparatus placed within a charge isolated conductor is "shielded" from electric field.

A Spherically Symmetric Charge Distribution



The external electric field near the surface of charged conductor is perpendicular to the surface and has a magnitude that depends on the surface charge density σ

$E = \frac{\sigma}{\epsilon o}$

Within the conductor E = 0

The electric intensity inside the conductor must be zero. "An excess charge on an isolated conductor is located entirely on the outer sphere of the conductor."

The electric intensity inside the conductor must be zero. Suppose a hollow conducting sphere of radius r. We place a Gaussian surface inside hollow charged sphere.

Applying Gauss law,

$\Phi_E = \frac{q}{\epsilon o}$

We know q = 0 inside Gaussian surface.

$\Phi_E = \frac{0}{\epsilon o}$

Also $\Phi_E = \bar{E}.\bar{A}$

$\bar{E}.\bar{A} = 0$

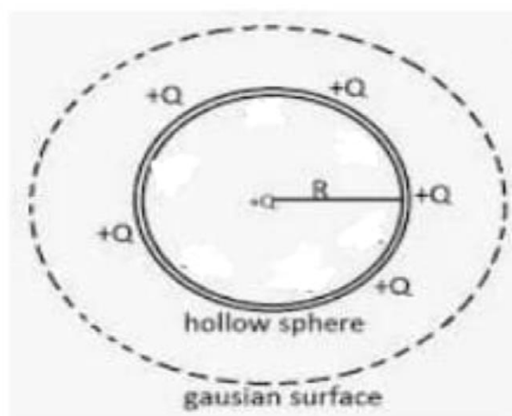
$\bar{A} \neq 0, \bar{E} = 0$

Thus any apparatus placed within a charge isolated conductor is "shielded" from electric field.

Suppose a spherical Gaussian surface outside the hollow conducting sphere. There is uniform surface charge density σ

$\sigma = \frac{q}{A} \Rightarrow q = \sigma A$

Applying Gauss law to find out electric intensity outside a spherically symmetric charge distribution.



$\Phi_E = \frac{q}{\epsilon o} = \frac{\sigma A}{\epsilon o}$

Also we have

$\Phi_E = \bar{E}.\bar{A}$

Then $\bar{E}.\bar{A} = \frac{\sigma A}{\epsilon o}$

$E = \frac{\sigma}{\epsilon o}$

Result:

The external electric field near the surface of charged conductor is perpendicular to the surface and has a magnitude that depends on the surface charge density σ

$E = \frac{\sigma}{\epsilon o}$

Within the conductor E = 0.