Suppose you have a hollow sphere and positive charges are distributed on its surface uniformly. What would be the electric field inside it? First, notice that due to symmetry the electric field must be on the radial direction. This is true. Second, as we know that electric fields are emanating from positive charges in every direction, you may guess that the electric field inside the hollow sphere would be given as in Fig. 1. However, if you take a Gaussian surface as in dotted region in Fig.1, you see that 8 numbers of electric flux are coming in. So, there should be a negative charge inside the Gaussian surface. However, there is no electric charge inside the Gaussian surface. So, the conclusion is that no electric field should exist inside the hollow sphere, as in Fig.2. This is the power of Gauss's law. We derived this result without any complicated calculations. Actually, one can obtain the same result by using the inverse square law. It requires complicated calculations that involve calculus. The basic idea is summing over all the contributions to the electric field due to each electric charge distributed over the surface of the sphere. Then, it can be shown that the contributions from the surface of sphere miraculously cancel one another, making the electric field inside the sphere zero.

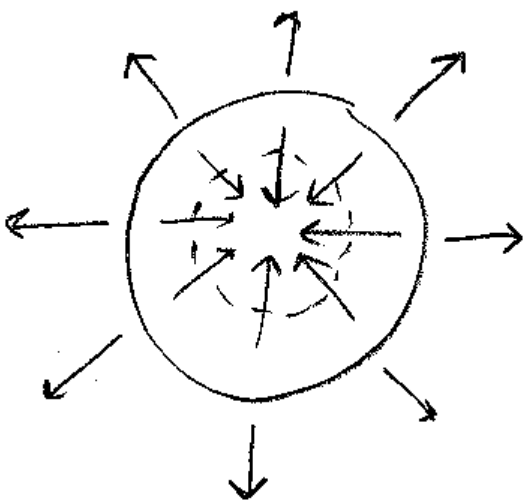

Fig 1

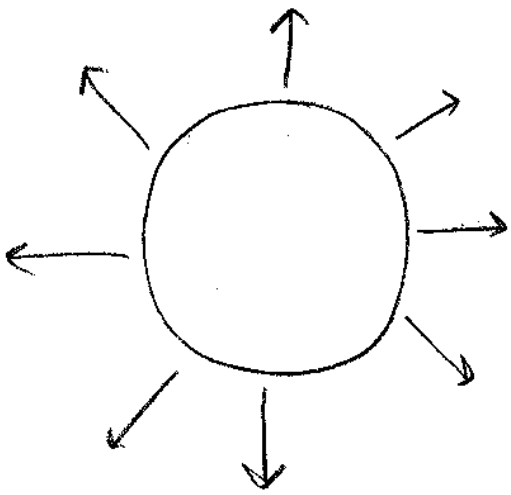

Fig 2

Summary

Using Gauss's law it is easy to show that the electric field inside spherical shell is zero, if the charge on the shell is uniformly distributed.