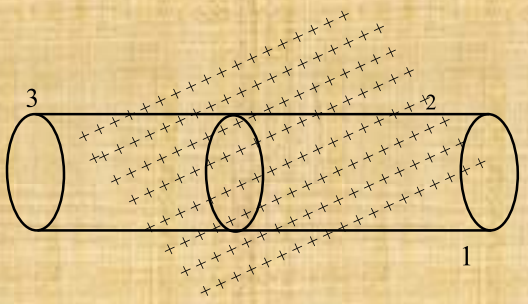
Brainbox learn easy

Chapter 01

ELECTRIC CHARGES AND FIELDS

Electric field due to infinite non conducting plane sheet of charge.



Let us consider an infinite of nonconducting plane charged sheet with surface charge density σ.

The direction of electric field $\vec{E}$ is normal tp the plane on both sides.

Let us construct a gaussian surface in the form of a cylinder to enclose the charge in the area S.

The flux through the cylindrical surface

$$\phi = \iint \vec{E}\, \overrightarrow{ds_1} + \iint \vec{E}\, \overrightarrow{ds_2} + \iint \vec{E}\, \overrightarrow{ds_3}$$

$$= Es + 0 + Es \qquad [s_1 = s_3 = s]$$

$$\phi = 2Es \rightarrow (1)$$

But from gauss law,

$$\phi = \frac{e_{enclosed}}{\epsilon_0} = \frac{\sigma s}{\epsilon_0} \rightarrow (2) \qquad [\because q = \sigma s]$$

From (1) & (2)

$$2Es = \frac{\sigma s}{\epsilon_0}$$

$$\therefore E = \frac{\sigma}{2 \in_0}$$

The magnitude of $\vec{E}$ is independent of the distance.