

## Answer on Question 59027, Physics, Electromagnetism

### Question:

From Gauss's law which of the following is not correct:

a) The outward flux of electric field through an enclosed surface is proportional to the electric charges enclosed.

b) The field at a point outside a spherically symmetric charge is the same as the electric field at the same point due to a point charge at its centre.

c) The electric flux through a Gaussian surface is a vector product of the electric field and a unit vector perpendicular to and outward from the surface.

d) The total electric flux through a cylinder placed in an electric field with its axis parallel to the field is zero.

### Answer:

The Gauss's law states that the net electric flux through any closed surface is equal to  $1/\epsilon$  times the net electric charge within that closed surface. Gauss's law can be written mathematically as follows:

$$\Phi_E = \frac{Q}{\epsilon_0},$$

here,  $\Phi_E$  is the electric flux through a closed surface  $S$  enclosing any volume  $V$ ,  $Q$  is the total charge enclosed within  $S$ , and  $\epsilon_0$  is the permittivity of free space.

The electric flux  $\Phi_E$  is defined as a surface integral of the electric field:

$$\Phi_E = \oint \mathbf{E} \cdot d\mathbf{A},$$

here,  $\mathbf{E}$  is the electric field,  $d\mathbf{A}$  is the vector representing an infinitesimal element of area of the surface, symbol dot ( $\cdot$ ) represents the dot product of two vectors.

Finally, we get:

$$\oint \mathbf{E} \cdot d\mathbf{A} = \frac{Q}{\epsilon_0}.$$

From the definition of the Gauss's law we can see, that the third statement c) is wrong, because there is no vector product in the mathematical definition of the law.