CheckPoint 2

Definition of Flux:

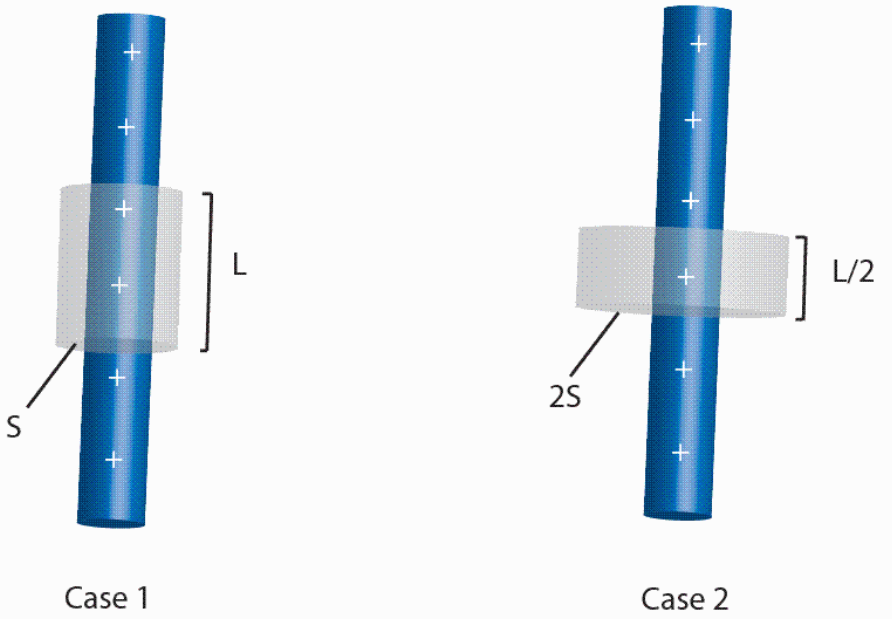
$$\Phi \equiv \int_{surface} \vec{E} \cdot d\vec{A}$$

E constant on barrel of cylinder
E perpendicular to barrel surface
(E parallel to dA)

$$\Phi = E \int_{barrel} d\vec{A}$$

$$= EA_{barrel}$$

2) An infinitely long charged rod has uniform charge density of λ, and passes through a cylinder (gray). The cylinder in case 2 has twice the cross sectional area and half the length compared to the cylinder in case 1.



$\Phi_1 = 2\Phi_2$	$\Phi_1 = \Phi_2$	$\Phi_1 = 1/2\Phi_2$	none
(A)	(B)	(C)	(D)

RESULT: GAUSS' LAW
Φ proportional to charge enclosed !

Case 1

$$A_{barrel} = 2\pi sL$$

$$E_1 = \frac{\lambda}{2\pi\varepsilon_0 s} \rightarrow \Phi_1 = \frac{\lambda L}{\varepsilon_0}$$

Case 2

$$A_2 = (2\pi(2s))L/2 = 2\pi sL$$

$$E_2 = \frac{\lambda}{2\pi\varepsilon_0(2s)} \rightarrow \Phi_2 = \frac{\lambda(L/2)}{\varepsilon_0}$$