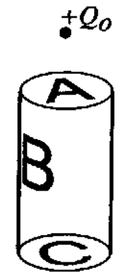
II. Gauss' law

Gauss' law states that the electric flux through a Gaussian surface is directly proportional to the net charge enclosed by the surface ($\Phi_E = q_{enclosed}/\varepsilon_o$).

~~A. Are your answers to parts A–C of section I consistent with Gauss' law? Explain.~~

B. In part D of section I, you tried to determine the sign of the flux through the Gaussian cylinder shown.



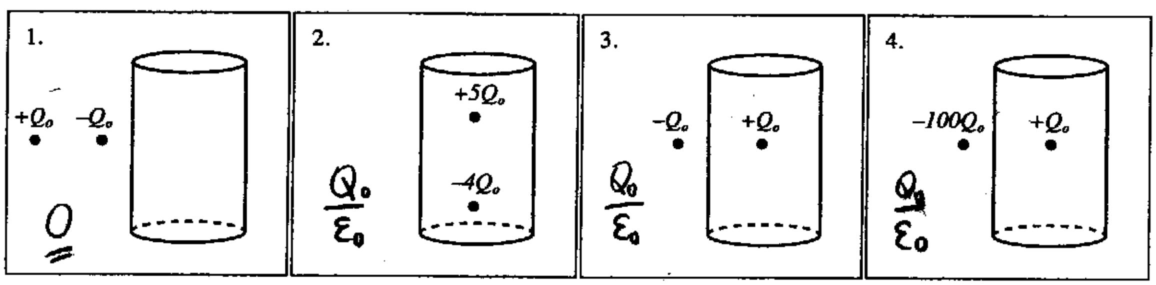
1. If you have not done so already, use Gauss' law to determine whether the net flux through the Gaussian surface is *positive, negative,* or *zero*. Explain.

   Zero : by Gauss' Law , no charge enclosed

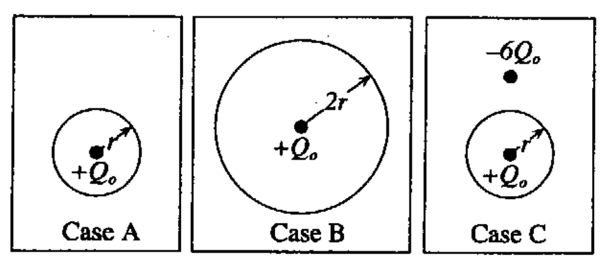
2. If $\Phi_A = -10$ Nm²/C and $\Phi_C = 2$ Nm²/C, what is Φ_B?

   $\Phi_A + \Phi_B + \Phi_C = 0$ $\Phi_B = 10 - 2 = 8\ Nm^2/C$

C. Find the net flux through each of the Gaussian surfaces below.



D. The three spherical Gaussian surfaces at right each enclose a charge $+Q_o$. In case C there is another charge $-6Q_o$ outside the surface.



Consider the following conversation:

Student 1: *"Since each Gaussian surface encloses the same charge, the net flux through each must be the same."* ✓

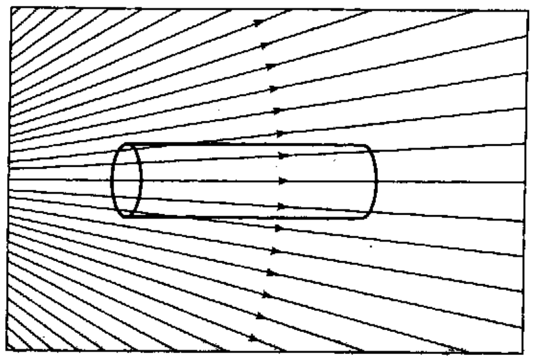
Student 2: *"Gauss' law doesn't apply here. The electric field at the Gaussian surface in case B is weaker than in case A, because the surface is farther from the charge. Since the flux is proportional to the electric field strength, the flux must also be smaller in case B."* X

Student 3: *"I was comparing A and C. In C the charge outside changes the field over the whole surface. The areas are the same, so the flux must be different."* X

Do you agree with any of the students? Explain.

Gauss' Law applies. Flux depends only on enclosed charged

A cylindrical piece of insulating material is placed in an external electric field, as shown. The net electric flux passing through the surface of the cylinder is



1. positive.
2. negative.
3. zero.

No charge enclosed!