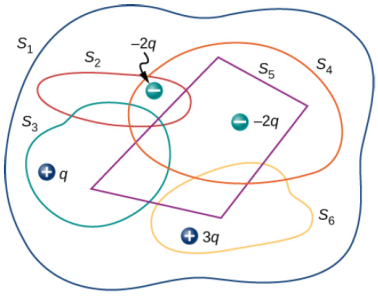
Chapter 6 Problem 30 †



Solution

Find the flux through each surface whose cross-section is shown below.

To start with, the electric flux is equal to the total charge enclosed by the surface divided by ϵ_0.

S_1 encloses all the charge, so the flux is

$$\Phi_1 = \frac{q + (-2q) + 3q + (-2q)}{\epsilon_0} = 0 \; Nm^2/C$$

S_2 encloses just one charge so the flux is

$$\Phi_2 = \frac{-2q}{\epsilon_0} = \frac{-2q}{\epsilon_0} \; Nm^2/C$$

S_3 encloses just one charge so the flux is

$$\Phi_3 = \frac{q}{\epsilon_0} = \frac{q}{\epsilon_0} \; Nm^2/C$$

S_4 encloses two charges so the flux is

$$\Phi_4 = \frac{-2q + (-2q)}{\epsilon_0} = \frac{-4q}{\epsilon_0} \; Nm^2/C$$

S_5 encloses just one charge so the flux is

$$\Phi_5 = \frac{-2q}{\epsilon_0} = \frac{-2q}{\epsilon_0} \; Nm^2/C$$

S_6 encloses just one charge so the flux is

$$\Phi_6 = \frac{3q}{\epsilon_0} = \frac{3q}{\epsilon_0} \; Nm^2/C$$

If the value of q was given, then we could compute a numerical answer for each surface.

†Problem from Univesity Physics by Ling, Sanny and Moebs (OpenStax)