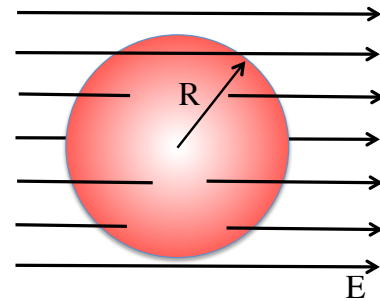


Problem 24.18

Determine the net flux through the surface if it is:

a.) the sphere:

Looking at the sketch, it is clear that there are as many electric field lines enter the sphere as exit the sphere, so the net flux through the sphere will be zero. Alternately, as there is no charge enclosed inside the sphere, the net flux must, by Gauss's Law, be zero.



b.) the cylinder:

Electric field lines are passing through both end-caps but not through the cylindrical surface, so the total flux is the flux through one cap doubled:



$$\begin{aligned}\Phi_E &= 2\vec{E} \cdot \vec{A} = 2E A \cos 0^\circ \\ &= 2E(\pi R^2)(1) \\ &= 2\pi R^2 E\end{aligned}$$

1.)

c.) What kind of charge configuration would produce a uniform electric field like this?

Though it may or may not be evident, a field like this can be generated by a plane of charge parallel to the end-caps. As the electric field lines are exiting the end-caps, the charge on the plane must be *positive*.



2.)