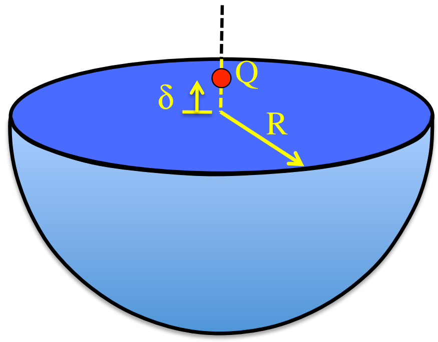
Problem 24.17



A charge Q is positioned as shown above the face of a hemisphere or radius R.

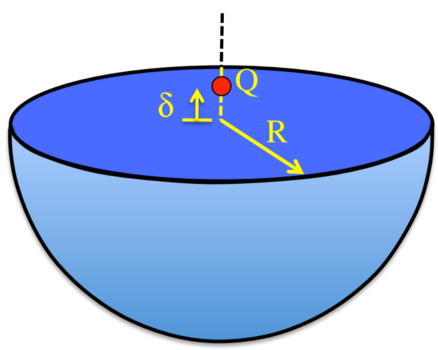
a.) Determine the electric flux through the curved surface.

As long as δ is very small, the distance between the charge and any point on the curved surface is essentially the same.
That means the magnitude of the electric field intensity at each point on the curve is essentially the same, and will equal: $E = \frac{1}{4\pi\varepsilon_o}\frac{Q}{R^2}$

So the flux through the hemisphere is

$$\Phi_E = \vec{E} \bullet \vec{A} = \quad E \quad A \quad \cos 0^\circ$$
$$= \left(\frac{1}{4\pi\varepsilon_o}\frac{Q}{R^2}\right)\left(\left(\frac{1}{2}\right)\left(4\pi R^2\right)\right)(1)$$
$$= \frac{Q}{2\varepsilon_o}$$

b.) Determine the electric flux through the flat face.



This has to be $\frac{-Q}{2\varepsilon_o}$

Why? There is no charge *inside* the hemisphere, so the only flux *leaving* the curved surface has to have *entered* through the flat surface. Flux leaving is always positive and flux entering is always negative, so the solution will be *negative* the solution to *Part a*.