39. The proton is in uniform circular motion, with the electrical force of the sphere on the proton providing the centripetal force. According to Newton's second law, $F = mv^2/r$, where F is the magnitude of the force, v is the speed of the proton, and r is the radius of its orbit, essentially the same as the radius of the sphere. The magnitude of the force on the proton is $F = eq/4\pi\varepsilon_0 r^2$, where q is the magnitude of the charge on the sphere. Thus,

$$\frac{1}{4\pi\varepsilon_0}\frac{eq}{r^2} = \frac{mv^2}{r}$$

so

$$\begin{aligned} q &= \frac{4\pi\varepsilon_0 mv^2 r}{e} = \frac{(1.67\times10^{-27}\,\text{kg})(3.00\times10^{5}\,\text{m/s})^2(0.0100\,\text{m})}{(8.99\times10^{9}\,\text{N}\cdot\text{m}^2/\text{C}^2)(1.60\times10^{-19}\,\text{C})} \\ &= 1.04\times10^{-9}\ \text{C}\ . \end{aligned}$$

The force must be inward, toward the center of the sphere, and since the proton is positively charged, the electric field must also be inward. The charge on the sphere is negative: $q = -1.04\times10^{-9}\,\text{C}$.