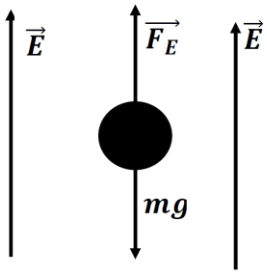
31. A small drop of water is suspended motionless in air by a uniform electric field that is directed upward and has a magnitude of 8480 N/C. The mass of the water drop is 3.50×10^{-9} kg. **(a)** Is the excess charge on the water drop positive or negative? Why? **(b)** How many excess electrons or protons reside on the drop?



To suspend the water in air, the force from the electric field must point up, so that tells us the charge must be positive since the force is in the same direction as the applied electric field.

$$\sum F_y = F_E - mg = ma_y = 0$$

$$F_E = mg = qE$$

Solve for q

$$q = \frac{mg}{E} = Ne$$

Solve for number of fundamental charges must be present.

$$N = \frac{mg}{eE} = \frac{(3.50\ x\ 10^{-9}\ kg)\left(9.80\ {}^{m}/_{s^2}\right)}{(1.6\ x\ 10^{-19} C)\left(8480\ {}^{N}/_{C}\right)} = 2.528\ x\ 10^{7}$$

$$\boxed{N = 2.53\ x\ 10^{7}\ Excess\ Protons}$$

Dr. Donovan's Classes Page	Dr. Donovan's PH 202 Homework Page
NMU Physics Department Web Page	NMU Main Page

Please send any comments or questions about this page to ddonovan@nmu.edu

This page last updated on September 14, 2023