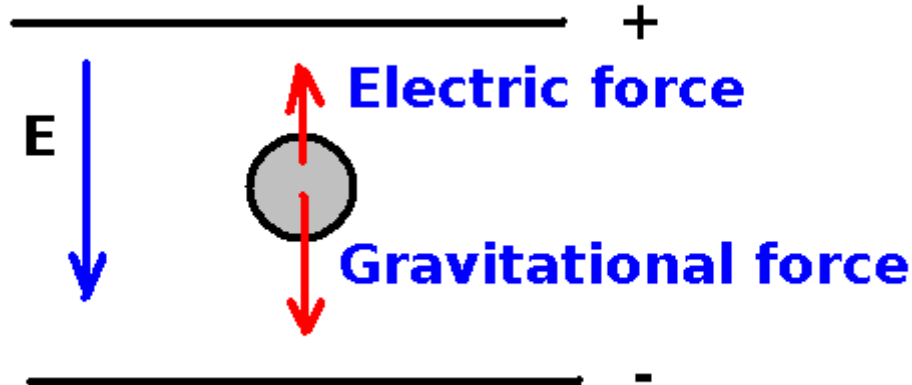


## Millikan Oil Drop Experiment

1923 Nobel prize  
(a simplified version)



A charged oil drop ( $Q$ ) of radius  $R$  and density  $\rho$  is placed between the plates of a capacitor (separated by a distance  $d$ ) with a potential difference  $\Delta V$ . The potential difference is varied until the drop of oil is suspended between the plates. From this we can find the charge on the drop.

$$F_E - F_g = 0 \Rightarrow Q \left[ \frac{\Delta V}{d} \right] = \frac{4}{3} \pi R^3 \rho g \Rightarrow Q = \frac{\frac{4}{3} \pi R^3 \rho g}{\left[ \frac{\Delta V}{d} \right]}$$

In fact, there are significant difficulties with this measurement and in addition, the charge on the droplet changes periodically. The mass of the droplet is measured by measurement of the radius through the same microscope which is used to view the oil droplet. From this work, however, we can determine the charge on the electron.

In the actual work, the drops were allowed to drop, reaching a terminal velocity which required the use of the viscosity of air. Millikan in his original work used a value which was a little bit too low and his results were off a bit accordingly.

The presently accepted value from CODATA for the charge on the electron is  $1.602\,176\,565 \times 10^{-19} \text{ C}$ .