An oil drop 'B' has charge 1.6×10^{-19} C and mass 1.6×10^{-14} kg. If the drop is in equilibrium position, let 10 k be the potential diff. between the plates. [The distance between the plates is 100 mm] Then what is the value of k.

Solution

In this case we can see the equilibrium between two forces: weight and electrostatic force.

$$mg = F_{el} = qE,$$

where m – mass of drop, g – gravity constant, q – charge of drop.

For a flat capacitor:

$$E = \frac{V}{d},$$

where V - the potential difference between the plates, d - the distance between the plates.

Now we have:

$$mg = q\frac{V}{d} = 10 * \frac{q * k}{d}.$$

So for constant k:

$$k = \frac{1}{10}\frac{m * g * d}{q} = \frac{1}{10}\frac{1.6 \times 10^{-14} * 9.8 * 100 * 10^{-3}}{1.6 \times 10^{-19}} = 9.8 * 10^3 \, V = 9.8 \, kV.$$

Answer: $9.8 \, kV$.