Answer on Question #58644, Physics / Electromagnetism

Task. Calculate the potential difference between the plates of a parallel plate capacitor so that the gravitational force on a proton would be balanced by the electric field (proton mass =1.67×10−27kg, electronic charge e=1.6×10−19C, plate separation is 0.5cm. Take g=9.8m/s2)

Solution

From 2nd Newton's law:

$$0 = mg - F_{el}$$

$$F_{el} = eE_{el} = \frac{eU}{d}$$

Where m – mass of proton, e – proton charge, U – potential difference, d – plate separation.

$$mg = \frac{eU}{d} \rightarrow U = \frac{mgd}{e} = \frac{9.8 \cdot 1.67 \cdot 10^{-27} \cdot 0.5 \cdot 10^{-2}}{1.6 \cdot 10^{-19}} = 5.11 \cdot 10^{-10}\ V$$

$$\approx 5 \cdot 10^{-10}\ V$$

Answer

$$U = 5 \cdot 10^{-10}\ V$$