Solution

The capacitance of two concentric cylinders per unit length is

$$C = \frac{2\pi\epsilon_0}{\ln b/a}$$

(see HW3 - problem 1.6c from Jackson). For a capacitor filled with dielectric $\epsilon_0 \longrightarrow \epsilon$ so the capacitance of the setup is

$$C = \frac{2\pi\epsilon_0}{\ln b/a}[L - h + h\frac{\epsilon}{\epsilon_0}] = \frac{2\pi\epsilon_0}{\ln b/a}[L + h\chi_e]$$

and therefore $W = \frac{\pi\epsilon_0}{\ln b/a}[L + h\chi_e]V^2$ Using formula

$$F = \frac{\partial W}{\partial h}_V = \frac{\pi\epsilon_0\chi_e}{\ln b/a}V^2$$

In the equilibrium position this force is balanced by weight $mg = \rho g h\pi(b^2 - a^2)$ so we get

$$h = \frac{\epsilon_0\chi_e V^2}{\rho g(b^2 - a^2)\ln b/a}$$