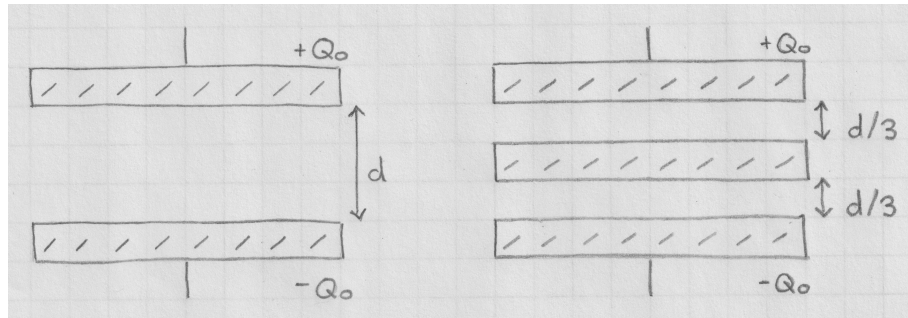


[lex53] Insertion of conducting slab between capacitor plates I

A parallel-plate capacitor with plates of area A and a gap of width d is charged up to Q_0 and then disconnected from the voltage source. The capacitance is $C_0 = \epsilon_0 A/d$ and the voltage is $V_0 = Q_0/C_0$. The electric field between the plates is $E_0 = V_0/d$ and the energy stored in the device is $U_0 = Q_0^2/2C_0$.

Now a conducting slab of cross-sectional area A and width $d/3$ is inserted symmetrically between the plates as shown. Find the voltage V between the plates, the electric field E in the two gaps, the capacitance C of the modified device, and the energy U stored in it, in units of V_0 , E_0 , C_0 , and U_0 , respectively.



Solution: