

15. Let x be the separation of the plates in the lower capacitor. Then the plate separation in the upper capacitor is $a - b - x$. The capacitance of the lower capacitor is $C_\ell = \varepsilon_0 A/x$ and the capacitance of the upper capacitor is $C_u = \varepsilon_0 A/(a - b - x)$, where A is the plate area. Since the two capacitors are in series, the equivalent capacitance is determined from

$$\frac{1}{C_{\text{eq}}} = \frac{1}{C_\ell} + \frac{1}{C_u} = \frac{x}{\varepsilon_0 A} + \frac{a - b - x}{\varepsilon_0 A} = \frac{a - b}{\varepsilon_0 A} .$$

Thus, the equivalent capacitance is given by $C_{\text{eq}} = \varepsilon_0 A/(a - b)$ and is independent of x .