

74. (a) The length d is effectively shortened by b so $C' = \varepsilon_0 A / (d - b)$.
(b) The energy before, divided by the energy after inserting the slab is

$$\frac{U}{U'} = \frac{q^2 / 2C}{q^2 / 2C'} = \frac{C'}{C} = \frac{\varepsilon_0 A / (d - b)}{\varepsilon_0 A / d} = \frac{d}{d - b} .$$

- (c) The work done is

$$W = \Delta U = U' - U = \frac{q^2}{2} \left(\frac{1}{C'} - \frac{1}{C} \right) = \frac{q^2}{2\varepsilon_0 A} (d - b - d) = -\frac{q^2 b}{2\varepsilon_0 A} .$$

Since $W < 0$ the slab is sucked in.