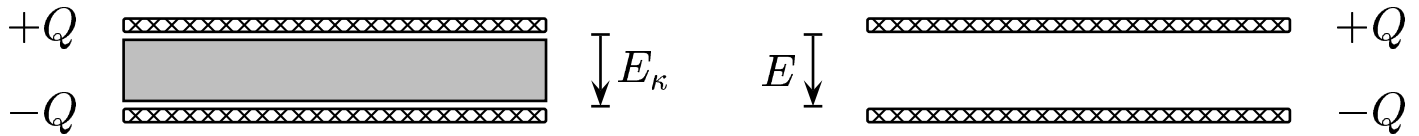


Two parallel-plate capacitors are shown below. Both are identical except one has a dielectric slab inserted into the gap between the plates. Both capacitors contain the identical charges on their plates.

$$\text{Hint: } E_{\kappa} = \frac{E}{\kappa}, \quad u = \frac{U}{A d}, \quad u_{\kappa} = \frac{U_{\kappa}}{A d}, \quad U = \frac{Q^2}{2 C}, \quad \text{and } U_{\kappa} = \frac{Q^2}{2 C_{\kappa}}.$$



Find the ratio of the energy densities $\frac{u_{\kappa}}{u}$.

- A) $\frac{u_{\kappa}}{u} = 1$
 B) $\frac{u_{\kappa}}{u} = \kappa$
 C) $\frac{u_{\kappa}}{u} = \frac{1}{\kappa}$

$$u = \frac{U}{A d}, \quad \text{and} \quad U = \frac{Q^2}{2 C} = \frac{\epsilon_0 E^2}{2}$$

$$u_{\kappa} = \frac{U_{\kappa}}{A d}, \quad \text{and} \quad U_{\kappa} = \frac{Q^2}{2 \kappa C} = \frac{\epsilon_0 E^2}{2 \kappa} = \frac{\epsilon_0 \kappa^2 E_{\kappa}^2}{2 \kappa} = \kappa \frac{\epsilon_0 E^2}{2}$$

$$\frac{u_{\kappa}}{u} = \kappa.$$

Answer **B**.