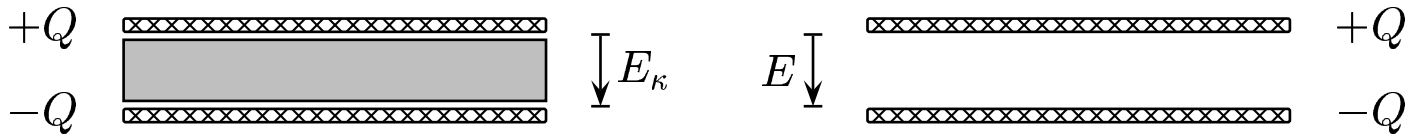


Two parallel-plate capacitors are shown below. Both are identical except one has a dielectric slab inserted into the gap between the plates. Both capacitors contain the identical charges on their plates.

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



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

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

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

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

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

Answer **B**.