Consider a typical capacitor, such as a parallel plate capacitor or a spherical capacitor. For each case, capacitance is defined by $C \equiv \dfrac{Q}{V}$. In the presence of a dielectric with a dielectric constant ($\kappa > 1$), while keeping Q fixed, the electric field between the gap will be reduced to $E' = \dfrac{E}{\kappa}$.

Prior to the insertion of a dielectric we have the electric potential V and the capacitance C and after inserting a dielectric we have V' and C', respectively.

Choose the appropriate relationships.

A) $V' = \kappa\, V$ and $C' = \kappa\, C$

B) $V' = \kappa\, V$ and $C' = \dfrac{\kappa}{C}$

C) $V' = \dfrac{V}{\kappa}$ and $C' = \kappa\, C$

D) $V' = \dfrac{V}{\kappa}$ and $C' = \dfrac{C}{\kappa}$

E) $V' = V$ and $C' = C$

Since $V = E\, d$, we have

$$V' = E'\, d = \frac{E\, d}{\kappa} = \frac{V}{\kappa},$$

and since $C \equiv \dfrac{Q}{V}$, we have

$$C' = \frac{Q}{V'} = \frac{\kappa\, Q}{V} = \kappa\, C\,.$$

Answer **C**.