

Problem 6.22 If we were to characterize how good a material is as an insulator by its resistance to dissipating charge, which of the following two materials is the better insulator?

$$\begin{array}{ll} \text{Dry Soil:} & \epsilon_r = 2.5, \quad \sigma = 10^{-4} \text{ (S/m)} \\ \text{Fresh Water:} & \epsilon_r = 80, \quad \sigma = 10^{-3} \text{ (S/m)} \end{array}$$

Solution: Relaxation time constant $\tau_r = \frac{\epsilon}{\sigma}$.

$$\text{For dry soil,} \quad \tau_r = \frac{2.5}{10^{-4}} = 2.5 \times 10^4 \text{ s.}$$

$$\text{For fresh water,} \quad \tau_r = \frac{80}{10^{-3}} = 8 \times 10^4 \text{ s.}$$

Since it takes longer for charge to dissipate in fresh water, it is a better insulator than dry soil.
