

10.25 Which of the following media may be treated as conducting at 8 MHz?

(a) Wet marshy soil ($\epsilon = 15\epsilon_0$, $\mu = \mu_0$, $\sigma = 10^{-2}$ S/m)

(b) Intrinsic germanium ($\epsilon = 16\epsilon_0$, $\mu = \mu_0$, $\sigma = 0.025$ S/m)

(c) Seawater ($\epsilon = 81\epsilon_0$, $\mu = \mu_0$, $\sigma = 25$ S/m)

$$\text{loss tangent} = \tan \theta = \frac{\sigma}{\omega \epsilon} \quad (10.37)$$

$$a) \quad \tan \theta = \frac{10^{-2}}{2\pi(8 \times 10^6)15(8.854 \times 10^{-12})} = 1.4979 \not\gg 1$$

soil \Rightarrow semiconductor @ best / lossy

$$b) \quad \tan \theta = \frac{0.025}{2\pi(8 \times 10^6)16(8.854 \times 10^{-12})} = 3.5107 \not\gg 1$$

germanium \Rightarrow semiconductor / lossy

c) Seawater

$$\tan \theta = \frac{25}{2\pi(8 \times 10^6)81(8.854 \times 10^{-12})} = 693.48 \gg 1$$

\Rightarrow Seawater is a conductor