

Problem 7.15 For each of the following combinations of parameters, determine if the material is a low-loss dielectric, a quasi-conductor, or a good conductor, and then calculate α , β , λ , u_p , and η_c :

- (a) Glass with $\mu_r = 1$, $\epsilon_r = 5$, and $\sigma = 10^{-12}$ S/m at 10 GHz.
- (b) Animal tissue with $\mu_r = 1$, $\epsilon_r = 12$, and $\sigma = 0.3$ S/m at 100 MHz.
- (c) Wood with $\mu_r = 1$, $\epsilon_r = 3$, and $\sigma = 10^{-4}$ S/m at 1 kHz.

Solution: Using equations given in Table 7-1:

	Case (a)	Case (b)	Case (c)
$\sigma/\omega\epsilon$	3.6×10^{-13}	4.5	600
Type	low-loss dielectric	quasi-conductor	good conductor
α	8.42×10^{-11} Np/m	9.75 Np/m	6.3×10^{-4} Np/m
β	468.3 rad/m	12.16 rad/m	6.3×10^{-4} rad/m
λ	1.34 cm	51.69 cm	10 km
u_p	1.34×10^8 m/s	0.52×10^8 m/s	0.1×10^8 m/s
η_c	$\simeq 168.5 \Omega$	$39.54 + j31.72 \Omega$	$6.28(1 + j) \Omega$
