1) Is it possible for a waveguide to have the second-lowest cut-off frequency be three times the lowest cut-off frequency? Why or why not? (Explain your answer.)
2) A waveguide with dimensions 7.0 cm $\times$ 3.0 cm is propagating a wave in the lowest-order mode with a frequency 30% higher than the cut-off frequency. The guide is filled with a dielectric that has $\epsilon = 4\epsilon_0$ and $\mu = \mu_0$.

a) What would be the wavelength of this signal if no waveguide were present (i.e., what would be the wavelength of a plane wave propagating in the material)?

b) What is the wavelength along the waveguide axis (i.e., $\lambda_g$)?

c) What would be the cut-off frequency of this waveguide if the dielectric material were removed?