1. The “lower hybrid wave” has \( \mathbf{k} = k\hat{x} \) perpendicular to an ambient uniform magnetic field \( \mathbf{B}_0 = B_0\hat{z} \). Its frequency is above the ion cyclotron frequency \( \Omega_i = eB_0/m_ic \) and below the electron cyclotron frequency \( \Omega_e = eB_0/m_ec \). Take \( \Omega_i \ll \omega \ll \Omega_e \) and derive the wave frequency in the limit in which both species are cold.

Hint: This wave is at a resonance so it is electrostatic. Simplify the electron and ions dynamics using the inequality above for \( \omega \).