General Physics Notes (07292026):

We'll go over some plasma physics.

$$\nabla^2 \cdot \phi = \frac{\rho}{\epsilon_0} \qquad \nabla \cdot E = \frac{\rho}{\epsilon_0} \qquad \nabla \cdot \phi = E \tag{1}$$

Let's find the dielectric constant ϵ for high frequency.

$$\nabla(\epsilon E) = 0 \qquad v = \frac{\omega n_1}{k n_0} \tag{2}$$

$$-ikE_1 = \frac{n_1}{\epsilon_0} \qquad E_1 = \frac{iq}{\epsilon_0 k} n_1 \tag{3}$$

A lot of this is about thing like the vector calculus, the wave recursion relation, and the form of the iterative solution to the Taylor expanded wave.

We get...

$$ikE_0 = -\frac{1}{\epsilon_0} q n_0 \left(\frac{-iqk}{m\omega} \right) E_1 \tag{4}$$

...or...

$$ik \left(1 - \frac{n_0 q^2}{\epsilon_0 m \omega^2} \right) E = 0 \tag{5}$$

This generates a solution.

$$\epsilon = 1 - \frac{\omega_p^2}{\omega^2} \tag{6}$$