E. M. S'04 # 11

The index of refraction is given by:

$$n = \sqrt{\frac{\mu}{\mu_0}\frac{\epsilon}{\epsilon_0}}$$

but $\mu \approx \mu_0$, so $n \approx \sqrt{\epsilon_r}$

Now for a plasma:

$$\epsilon_r = \frac{\epsilon(\omega)}{\epsilon_0} \approx 1 - \frac{\omega_p^2}{\omega^2} \quad ; \quad \omega_p^2 = \frac{n\tilde{Z}e^2}{\epsilon_0 m}$$

So

$$n(\omega) = \sqrt{1 - \frac{\omega_p^2}{\omega^2}} = \sqrt{1 - \frac{ne^2}{\epsilon_0 m \omega^2}}$$