Hint for HW#3

Problem 1 (problem 9.6 in Chuang)

The gain can be expresses as

$$g(\hbar\omega) = \frac{\pi\omega}{n_r c \varepsilon_0} \left| \hat{e} \cdot \vec{\mu}_{cv} \right|^2 \cdot \rho_r(\hbar\omega) \cdot \left(f_c - f_v \right)$$

$$= \frac{\pi e^2}{n_r c \varepsilon_0 m_0^2 \omega} \left| \hat{e} \cdot \vec{p}_{cv} \right|^2 \cdot \rho_r(\hbar\omega) \cdot \left(f_c - f_v \right)$$

$$\left| \hat{e} \cdot \vec{p}_{cv} \right|^2 = \frac{m_0}{6} E_p$$

E_p is tabulated in Appendix K (p. 709) for GaAs.

Note $n_r = \sqrt{\frac{\varepsilon_r}{\varepsilon_0}}$ is the refractive index of the material. The value of dielectric constant, ε_r, for GaAs can be found in Table K.1 on p. 708.