

1. Wave function (4 pts)

Hecht, problem 2.40:

Show that eqn. (2.64), which describes a plane wave of arbitrary form, satisfies the wave equation.

2. Photon flux (4 pts)

Hecht, problem 3.23:

How many photons per second are emitted from a 100 W yellow lightbulb (average wavelength, $\lambda = 550$ nm) if 2.5% of the applied energy is emitted as light? (The remainder is just dissipated as heat.)

3. Dielectric medium (2 pts)

Hecht, problem 3.41:

Determine the index of refraction of a medium that reduces the speed of light by 10% as compared to its speed in vacuum.

4. Inversion of the dispersion equation (4 pts)

Hecht, problem 3.53:

Show that the dispersion eqn. (3.70) can be rewritten as $1/(n^2 - 1) = -C/\lambda^2 + C/\lambda_0^2$ and determine C.

5. Application of the Cauchy equation (4 pts)

Hecht, problem 3.56:

Crystal quartz has refractive indices of $n_R = 1.557$ at $\lambda = 410.0$ nm and $n_R = 1.547$ at 550.0 nm. Using

$n_R \approx C_0 + C_1/\lambda^2 + O(\lambda^{-4})$, the Cauchy approximation, estimate n_R at 610.0 nm.

6. CO dissociation (2 pts)

Hecht, problem 3.58:

If a photon is to dissociate a CO molecule into oxygen and carbon atoms, it must provide 11 eV of energy. What is the frequency of this UV photon?