

Study Guide for chapter 13

1. Electromagnetic radiation.

Classical wave description: Know the electric and magnetic components are cosine functions. The field directions are perpendicular to each other and to the direction of wave propagation.

Classical wave description: Energy density of waves is proportional to what?

Know the conversion between wavelength, frequency and wave number.

Quantum description: write down the expression for the energy being absorbed by 1 mol of matter at a given wavelength.

2. Interaction between matter and radiation.

What are the two conditions for the interaction?

Write down the rate of transition in absorption and emission and define all terms.

Why is it difficult to design laser for UV and higher frequencies? Hint. Look at the ratio between the Einstein coefficients B_{ik} and A_{ik} .

For three states with the energies, $E_3=4k_B T$, $E_2=2 k_B T$, and $E_1=k_B T$. Which state is most populated and which state is least populated? Give the population ratios: n_1/n_2 , n_2/n_3 , and n_1/n_3 .

3. Selection rules.

For hydrogen atom, what is the selection rule for an electronic transition?

Which orbitals can a 3p orbital make a radiative transition to?