國立中央大學九十一學年度碩士班研究生入學試題卷

所別: 物理學系 不分組 科目: 近代物理 共 1 頁 第 1 頁

1. Photocurrent emitted from a cesium plate illuminated with ultraviolet light of wavelength 2000 Å are stopped by a potential of 4.2 eV . What is the work function of cesium? (10 %)
2. A γ ray creates an electron-positron pair production in the neighborhood of an electron and a nucleus at rest. Assume the recoil of the original electron and electron-positron pair move off together with the same kinetic energy, calculate the threshold energy of γ ray. (10%).
3. If $\Delta\lambda/\lambda = 10^{-7}$ for a photon, what is the simultaneous value Δx for $\lambda = 5000$ Å? (10%)
4. (a) An electron is confined in a cubic box, assume the potential of this box is a three dimensional infinite square well potential, show the quantization energy of this electron. (10%).
   (b) If N non-interacting electrons are confined in this box, calculate the Fermi-energy of this system. (10%)
5. ^{11}Na atoms in ground state are placed in a magnetic field B. (a) Calculate the Zeeman splitting energy.(8%) (b) If an electromagnetic radiation of frequency ν is applied to this system, calculate the magnetic field B for the condition of electron spin resonance. (7%)
6. Consider an electron , confined in an one dimensional infinite square well potential, is making the transition from m to n energy level. (a) Calculate the matrix element of the electric dipole moment of this transition. (8%). (b) Determine the transition selection rule. (7%).
7. Explain the following terms briefly :
   (a) Spontaneous emission, stimulated absorption and the stimulated emission process for the two energy states of atom. (5%)
   (b) The magic number in nuclei. (5%)
   (c) Bose condensation of liquid helium. (5%)
   (d) Physical origin of spin-orbit interaction. (5%)