

大同大學 100 學年度研究所碩士班入學考試試題

考試科目：近代物理

所別：光電工程研究所

第 1/1 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

Ex.1) For what kinetic energy will a particle's de Broglie wavelength equal its Compton wavelength? (10%)

Ex.2) Photons of wavelength λ are incident on a metal. The most energetic electrons ejected from the metal are bent into a circular arc of radius R by a magnetic field having a magnitude B . What is the work function of the metal? (10%)

Ex.3) Show that $\Psi(x,t) = Ae^{i(kx-\omega t)}$ satisfies both the time-dependent Schrödinger equation and the classical wave equation. (10%)

Ex.4) Neglecting the electron spin, show that the number of degenerate states of the n th level of hydrogen is given by n^2 . (10%)

Ex.5) A helium-neon laser emits light of wavelength 632.8 nm and has a power output of 4 mW, how many photons are emitted per second by this laser? (10%)

Ex.6) What are the two postulates proposed by Einstein in his 1905 paper for the theory of special relativity? (10%)

Ex.7) Show that the relativistic kinetic energy should reduce to the nonrelativistic form for values of particle velocity of v that are small compared with the light speed of c . (10%)

Ex.8) For a free relativistic quantum particle moving with speed v , having the total energy of E and the momentum of p . For the quantum wave representing the relativistic particle, prove that the group speed of the wave is the same as the speed of the particle. (10%)

Ex.9) Why do lithium, potassium, and sodium exhibit similar chemical properties? (10%)

Ex.10) Find all possible values of L , L_z , and θ for a hydrogen atom in a $3d$ state. (10%)