Quantum Mechanics 1 – Problem 3

a) When a surface of a metal is illuminated with light of wavelength 512 nm, the maximum kinetic energy of the emitted electrons is measured to be 0.44 eV. When light of wavelength 365 nm is used, the maximum kinetic energy is 1.41 eV. From these observations, calculate the work function of the material and the value of Planck's constant. [5 marks]

b) A photon scatters through 180 degrees off a free, stationary electron. If the kinetic energy transferred to the electron is 35 keV, find the wavelength of the incident photon. You may assume that the electron is non-relativistic.

[Hint: The easiest way to solve this problem is by considering energy and momentum conservation. The relationship between the total energy of the electron, E_e, and its kinetic energy, T_e, is $E_e = T_e + m_e c^2$ (i.e. total energy equals kinetic energy plus rest energy). Remember that momentum is a vector quantity.]

[5 marks]