Problems for the exam Physics 2

1. Rays from two coherent light sources of $\lambda = 0.5\mu m$ and with a path difference of 0.5 mm arrive at a certain point in vacuum. Will the interference be constructive or not? Ans: constructive.
2. The distance between two coherent monochromatic point like light sources is 1.5 mm. The sources are located at 3,6 m from a screen so that the line connecting them is parallel to the screen. Compute λ if the interfringe is equal to 1.8 mm. Ans: $\lambda = 0.75\mu m$.
3. Show that the superposition of two light waves with the same wavelength, the same amplitude *A*, traveling along *Oz*, one polarized σ^+ and the other σ^- is a plane polarized wave with amplitude 2*A*.
4. In Young's experiment the holes are illuminated with light having $\lambda = 0.6\mu m$. The distance between the holes is 1 mm and from the holes to the screen 3 m. Find the positions of the first three maxima.
   Ans: 1.8 mm, 3.6 mm, 5.4 mm.
5. In Young's experiment a thin glass plate (*n*=1.5) is placed behind one of the slits. This produces the central maximum to shift into a position initially occupied by the 5th maximum (not counting the central one). $\lambda = 0.6\mu m$. What is the thickness of the plate?
   The glass plate of thickness *h* introduces an extra path difference equal to *h*(*n*-1). This additional difference in path equals 5λ. Ans: 0.6 μm
6. What velocity must an e^- travel with if its kinetic energy equals the energy of a photon with $\lambda = 0.52\mu m$? Ans: $9.2*10^5$ m/s
7. What velocity must an e^- travel with if its momentum equals that of a photon with $\lambda = 0.52\mu m$? Ans: 1400 m/s
8. X-ray with $\lambda_0 = 0.02nm$ undergoes Compton scattering at an angle $\theta = 90^\circ$. Find: $\Delta\lambda$, the energy and the momentum of the recoil e^-.
   Ans: 2.4 pm, 6.6 keV, $4.4*10^{-23}$kgm/s.
9. Find the de Broglie wavelength for electrons with kinetic energy of 10 keV and 1MeV. (attn to relativistic effects). m_0 is given.
   Ans: $1.22*10^{-11}$m, $8.7*10^{-13}$m.
10. Find the de Broglie wavelength for *H* atom traveling at 20°C with the most probable velocity. Ans: 0.18nm.
11. Find the kinetic, potential and total energy of an electron on the first Bohr orbit.
12. Determine the ionization potential of a *H* atom.