國立東華大學招生考試試題

招生學年度	101	招生類別	碩士班
系所班別	光電工程學系碩士班(甲組)		
科目	近代物理		
注意事項	本考科可使用掌上型計算機；內容以近代物理導論為主		

1. (10%) The energy of a particle is equal to 2.5×10^{-12} J, its momentum is 7.9×10^{-21} N s. What are its mass m and velocity v?

2. (10%) Compute the number of photons emitted in one second by a lamp of power 10 W, if the photon wavelength is 5×10^{-7} m.

3. (10%) An electron is constrained to bounce between two reflecting walls placed at a distance $d = 10^{-9}$ m from each other. Assuming that, as in the case of a stationary electromagnetic wave confined between two parallel mirrors, the distance d be equal to n half wavelengths, determine the possible values of the electron energy as a function of n.

4. (10%) A table-salt crystal is normally irradiated with an X-ray beam of wavelength $\lambda = 2.5 \times 10^{-10}$ m. The first order diffraction peak is observed at an angle equal to 26.3°. What is the interatomic distance of salt?

5. (10%) A star is away from earth with a velocity of 5×10^{-3} c. Compute the wavelength change of the sodium D_2 line, 589nm, according to the Doppler effect.

6. (10%) The energy of the emitted photoelectron is from 0 J to 4.0×10^{-19} J when an incident light with a wavelength of 300nm impinges on a metallic electrode. Compute the longest wavelength for exciting photoelectron?

7. (10%) Assume an Al plate with a thickness of x_{Al} mm is equal to a Pb plate with a thickness of 6mm for shading electromagnetic wave. The absorption coefficient of Al and Pb is $\alpha_{Al} = 0.044\text{mm}^{-1}$ and $\alpha_{Pb} = 5.8\text{mm}^{-1}$, respectively. Compute the thickness of the Al plate, x_{Al}.

8. (10%) Find out the minimum energy of (a) photon and (b) electron for resolving an object with a size of 0.25nm.

9. (10%) A photon with a wavelength of 300nm presents a wavelength deviation of 10^{-6}. According to the Heisenberg uncertainty principle, calculate the uncertainties of the position of the photon.

10. (10%) The shortest wavelength of the Balmer series (transitions down to the 2^{nd} state from higher states) of the atomic hydrogen emission spectrum is 365nm. (a) Find out the ionization energy of atomic hydrogen. (b) According to the ionization energy, compute the longest emission wavelength of Balmer series.