

Tutorial Sheet – 1: Unit 1: Modern Physics (PY-121) 2021-2022

Answer All the Questions

1. Assuming wave nature of EM waves, calculate the time required for the emission of photoelectron from a monoatomic layer of 1 cm^2 sodium wafer upon irradiation of a laser with intensity 10^{-6} W/m^2 . The work function of sodium is 2.3 eV and the lattice parameters of two-dimensional sodium wafer are $a = b = 4.29\text{ \AA}$ and the angle between a and b is 90° .
2. Calculate the average number of photons with energy 2 eV, inside a black body kept at 500 K.
3. The work function of barium and tungsten are 2.5 eV and 4.2 eV, respectively. Check whether these materials are useful in a photocell, which is to be used to detect visible light.
4. Calculate the mass of photoelectron emitted from a thin layer of gold upon irradiation of a photon of wavelength 50 nm. The work function of gold layer is 5.3 eV and the rest mass of electron is $9.1 \times 10^{-31}\text{ Kg}$.
5. Light of wavelength 2000 \AA falls on a metallic surface. If the work function of the surface is 4.2 eV, what is the kinetic energy of the fastest photoelectrons emitted? Also calculate the stopping potential and the threshold wavelength for the metal.
6. A photon of wavelength 40 \AA strikes an electron at rest and is scattered at an angle of 150° to its original direction. Find the wavelength of the photon after collision.
7. A change in wave length of a scattered photon is $2.9 \times 10^{-12}\text{ m}$ calculate the angle of scattered photon if an electron is emitted in the Compton process.
8. If the velocity of photoelectron emitted in a Compton process is $0.5c$, calculate the difference in wavelength of incident and the scattered photon.
9. What is the minimum energy (Threshold Energy) of photon required for an electron-positron creation process?