Answer on Question 60320, Physics, Quantum Mechanics

Question:

Light with a wavelength of $5.0 \cdot 10^{-7}\ m$ strikes a surface that requires $2.0\ eV$ to eject an electron. Calculate the maximum kinetic energy (in electron volts) of the emitted photoelectron.

Solution:

Using the mathematical description of the photoelectric effect, we can write the maximum kinetic energy E_{Kmax} of an emitted photoelectron as follows:

$$E_{Kmax} = hf - \varphi = h\frac{c}{\lambda} - \varphi,$$

here, $h = 4.135 \cdot 10^{-15}\ eV \cdot s$ is the Planck constant, f is the frequency of the incident photon, c is the speed of light, λ is the wavelength of the light and φ is the work function for the metal (energy required to eject an electron from the surface).

Then, we get:

$$E_{Kmax} = h\frac{c}{\lambda} - \varphi = 4.135 \cdot 10^{-15}\ eV \cdot s \cdot \frac{3 \cdot 10^8\ \frac{m}{s}}{5.0 \cdot 10^{-7}\ m} - 2.0\ eV =$$
$$= 2.5\ eV - 2.0\ eV = 0.5\ eV.$$

Answer:

$E_{Kmax} = 0.5\ eV.$