Answer on Question #68379-Physics / Quantum Mechanics

The work function of cesium is $\varphi = 1.96$ eV. If radiation of wavelength $\lambda = 4.00\times10^2$ nm is incident on the surface, find the kinetic energy of the ejected photoelectrons in eV and the speed of the ejected electrons.

Solution

The maximum kinetic energy of the ejected photoelectrons is given by

$$\mathrm{K_{max}} = \frac{\mathrm{hc}}{\lambda} - \varphi.$$

Here $\mathrm{h} = 6.62\times10^{-34}\ \mathrm{J\cdot s}$ is the Planck constant, $\mathrm{c} = 3\times10^8\ \mathrm{m/s}$ - speed of light.

So

$$\frac{hc}{\lambda} = \frac{6.62\times10^{-34}\times3\times10^8}{4.00\times10^2\times10^{-9}} = 4.96\times10^{-19}\ \mathrm{J} = 3.10\ \mathrm{eV}.$$

The maximum kinetic energy

$$K_{\max} = 3.10 - 1.96 = 1.14\ \mathrm{eV}.$$

The speed of the ejected electrons

$$v = \sqrt{\frac{2K_{\max}}{m}} = \sqrt{\frac{2\times1.14\times1.6\times10^{-19}}{9.1\times10^{-31}}} = 0.63\times10^6\,\frac{\mathrm{m}}{\mathrm{s}}.$$

Answer $K_{\max} = 1.14\ \mathrm{eV},\ \ v = 0.63\times10^6\,\frac{\mathrm{m}}{\mathrm{s}}$.