Answer on Question #58592, Physics / Quantum Mechanics

The emission of photoelectrons due to incident photons on the sodium surface stopped when a stopping potential of 4.2V is applied. Find wavelength of incident photons.

Find: λ – ?

Given:

U=4,2 V

A=2,36×1,6×10^{-19} J

e=-1,6×10^{-19} C

h=6,626×10^{-34} J×s

c=3×10^{8} m/s

Solution:

Equation of external photoelectric effect:

$\frac{hc}{\lambda} = A + \frac{mv_{max}^2}{2}$ (1),

where $\frac{hc}{\lambda}$ – energy of photon,

A – electron work function of the metal surface,

$\frac{mv_{max}^2}{2}$ – the maximum kinetic energy of the electron

The condition when the electron not reaches the second cathode:

$\frac{mv_{max}^2}{2} = |e|U$ (2),

where $|e|U$ – work of force of electric field

(2) in (1): $\frac{hc}{\lambda} = A + |e|U$ (3)

Of (3) $\Rightarrow$ $\lambda = \frac{hc}{A+|e|U}$ (4)

Of (4) $\Rightarrow$ λ=189×10^{-9} m

Answer:

189 nm