Question #50775, Physics, Nuclear Physics | for completion

A photo sensitive material surface is illuminated alternatively with light of wave length 3100Å and 6200Å. It is observed that maximum speed of the photo electron in two cases are in ratio 2:1 the work function of metal is.....
(hc=12400eVÅ)

λ_1 = 3100 Å

λ_2 = 6200 Å

h_c=12400eVÅ

$$\frac{V_1}{V_2} = \frac{2}{1}$$

A-?

Decision

Einstein's equation for the photoelectric effect: $h_c\nu = \frac{mV^2}{2} + A$

$V_1 = 2\ V_2$,

$\nu = \frac{c}{\lambda}$, there ν - the frequency of light, c - speed of light.

$$\begin{cases} h_c \frac{c}{\lambda_1} = \frac{mV_1^2}{2} + A \\ h_c \frac{c}{\lambda_2} = \frac{mV_2^2}{2} + A \end{cases}$$

$$\begin{cases} h_c \frac{c}{\lambda_1} = \frac{4mV_2^2}{2} + A \\ h_c \frac{c}{\lambda_2} = \frac{mV_2^2}{2} + A \end{cases}$$

$$\begin{cases} h_c \frac{c}{\lambda_1} = \frac{4mV_2^2}{2} + A \\ h_c \frac{c}{\lambda_2} - A = \frac{mV_2^2}{2} \end{cases}$$

$$h_c \frac{c}{\lambda_1} = 4(h_c \frac{c}{\lambda_2} - A) + A$$

$$h_c \frac{c}{\lambda_1} = 4h_c \frac{c}{\lambda_2} - 4A + A$$

$3A = 4h_c \frac{c}{\lambda_2} - h_c \frac{c}{\lambda_1} = h_c\, c(\frac{4}{\lambda_2} - \frac{1}{\lambda_1})$

$$A = \frac{h_c\, c}{3}\left(\frac{4}{\lambda_2} - \frac{1}{\lambda_1}\right)$$

$$A = \frac{12400 \cdot 1.6 \cdot 10^{-19} \cdot 3 \cdot 10^{8}}{3}\left(\frac{4}{6200} - \frac{1}{3100}\right) = 6{,}4 \cdot 10^{-11}\ \text{J}.$$

The work function of metal is $A = 6{,}4 \cdot 10^{-11}$ J.