Answer on Question #58598-Physics-Quantum Mechanics

Q. Show that energy E of a photon having wavelength λ can be written as E= (1240ev/ λ)nm.

Solution

Show that energy E of a photon is

$$E = h\nu = h\left(\frac{c}{\lambda}\right).$$

$$hc = 6.62606957 \cdot 10^{-34} J \cdot s \cdot 2.99792458 \cdot 10^{8} \frac{m}{s} = 1.9864457 \cdot 10^{-25} J \cdot m$$
$$= \left(\frac{1.9864457 \cdot 10^{-25}}{1.6 \cdot 10^{-19}}\right) eV \cdot m = 1.240 \cdot 10^{-5} eV \cdot m = 1240\ eV \cdot nm$$

Q. The energy needed to remove an electron from metallic sodium is 2.28ev. Does sodium show photo electric effect for red light having wavelength λ= 678 nm. What is cut off wavelength for photoelectric emission from sodium?

Solution

$$E = h\nu = h\left(\frac{c}{\lambda}\right) = \frac{1240\ eV \cdot nm}{\lambda} = \frac{1240\ eV \cdot nm}{678\ \text{nm}} = 1.83\ eV.$$

It is less than 2.28ev, thus photoelectric effect will not occur.

The cut off wavelength for photoelectric emission from sodium is

$$\lambda_{cutoff} = \frac{1240\ eV \cdot nm}{2.28\ \text{eV}} = 543\ nm.$$