

PREVIOUS YEAR QUESTION

If p is the momentum of the fastest electron ejected from a metal surface after the irradiation of light having wavelength λ , then for $1.5 p$ momentum of the photoelectron, the wavelength of the light should be: (Assume kinetic energy of ejected photoelectron to be very high in comparison to work function)

- A $1/2 \lambda$
- B $3/4 \lambda$
- C $4/9 \lambda$
- D $2/3 \lambda$

Explanation

From photoelectric effect,

$$E = \phi + KE$$

$$\frac{hc}{\lambda} = \phi + \frac{p^2}{2m} \dots\dots\dots (1)$$

Now when momentum = $1.5p$ then let wavelength = λ_1

$$\therefore \frac{hc}{\lambda_1} = \phi + \frac{(1.5p)^2}{2m} \dots\dots\dots (2)$$

Given,

kinetic energy(KE) of ejected photoelectron to be very high in comparison to work function(ϕ).

\therefore We can neglect work function(ϕ).

\therefore Equation (1) and (2) becomes,

$$\frac{hc}{\lambda} = \frac{p^2}{2m} \dots\dots\dots (1)$$

$$\frac{hc}{\lambda_1} = \frac{(1.5p)^2}{2m} \dots\dots\dots (2)$$

Dividing (1) by (2) we get,

$$\frac{\lambda_1}{\lambda} = \frac{p^2}{(1.5p)^2}$$

$$\Rightarrow \frac{\lambda_1}{\lambda} = \frac{4}{9}$$