Previous Year JEE Problems with Explanations

What is the work function of the metal if the light of wavelength 4000$\mathring{A}$ generates photoelectrons of velocity 6×10^5 ms^{-1} from it ?

(Mass of electron = 9×10^{-31} kg;

Velocity of light = 3×10^8 ms^{-1}

Plank's constant = 6.626×10^{-34} Js;

Charge of electron = 1.6×10^{-19} JeV^{-1})

A 4.0 eV

B 0.9 eV

C 2.1 eV

D 3.1 eV

Explanation

E = ϕ + K.E

$\Rightarrow h\nu = \phi + \frac{1}{2}mv^2$

$\Rightarrow \phi = h\nu - \frac{1}{2}mv^2$

$= \frac{6.626\times10^{-34}\times3\times10^8}{4000\times10^{-10}} - \frac{1}{2} \times 9 \times 10^{-31} \times \left(6 \times 10^5\right)^2$

$= 3.35 \times 10^{-19}$ J

$\Rightarrow \phi = \frac{3.35\times10^{-19}}{1.6\times10^{-19}}$ eV

$= 2.0934$ eV $\simeq 2.1$ eV