PREVIOUS YEAR QUESTION

6. A stream of electrons from a heated filament was passed between two charged plates kept at a potential difference V esu. If e and m are charge and mass of an electron, respectively, then the value of h/λ (where, λ is wavelength associated with electron wave) is given by **(2016 Main)**

(a) $2\,meV$

(b) $\sqrt{meV}$

(c) $\sqrt{2meV}$

(d) meV

Plan As you can see in options, energy term is mentioned hence, we have to find out relation between h/λ and energy. For this, we shall use de-Broglie wavelength and kinetic energy term in eV.

de-Broglie wavelength for an electron $(\lambda) = \dfrac{h}{p}$

$\Rightarrow \qquad\qquad\qquad p = \dfrac{h}{\lambda} \qquad\qquad\qquad …(i)$

Kinetic energy of an electron $= eV$

As we know that, $\text{KE} = \dfrac{p^2}{2m}$

$\therefore \qquad\qquad eV = \dfrac{p^2}{2m} \quad \text{or} \quad p = \sqrt{2meV} \qquad …(ii)$

From equations (i) and (ii), we get $\dfrac{h}{\lambda} = \sqrt{2meV}$