MIND MAP

Dual Nature

Planck's constant 'h' = 6.626×10^{-34} Js

1eV = 1.6×10^{-19} J

De-Broglie wavelength

$\lambda = \frac{h}{p}$ $\quad \lambda = \frac{h}{\sqrt{2m\,K.E.}}$

For electron

$\left(\lambda = \sqrt{\frac{150}{V}}\ \text{Å}\right)$

Particle of light is called as 'photon'.
It is packet of energy.

$E = \frac{hc}{\lambda} = h\nu = \frac{1242}{\lambda\ (\text{in nm})}$ in eV

Momentum of photon $P = \frac{h}{\lambda} = \frac{E}{c}$

Threshold wavelength

Maximum wavelength for which e^- just comes out is called threshold wavelength (λ_0).

$\frac{hc}{\lambda_0} = \phi$

Photoelectric effect will take place for $\lambda \le \lambda_0$

$KE_{max} = hc\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)$

Threshold frequency

Minimum frequency for which electron just comes out is called threshold frequency (ν_0).

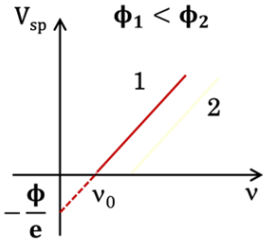
$h\nu_0 = \phi$

Photoelectric effect takes place for $\nu \ge \nu_0$.

$KE_{max} = h\nu - \phi = h\nu - h\nu_0$

$KE_{max} = h(\nu - \nu_0)$

Graph between V_{sp} and ν



$eV_{sp} = h\nu - \phi$

$V_{sp} = \left[\frac{h}{e}\right]\nu - \left[\frac{\phi}{e}\right]$

slope = $\frac{h}{e}$ independent of metals

Photon

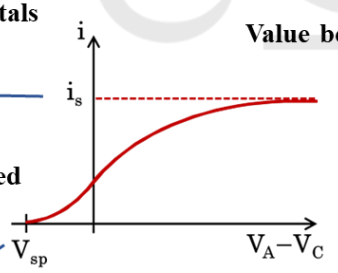
$0 \le KE \le h\nu - \phi$

$(KE)_{max} = h\nu - \phi$ — Einstein's Equation

Value between 0 to KE_{max}. — E_{photon} — Work Function → Minimum energy required to exit an electron from surface of the substance is called work function (F) of the substance.

Saturation Current i_s

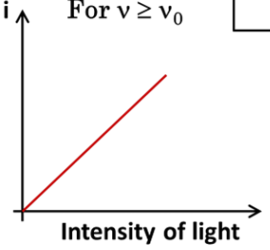
The maximum value of photoelectric current is called saturation current.

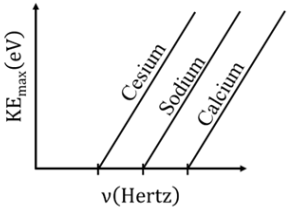


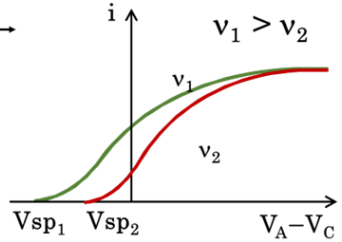
Stopping Potential V_{sp}

The value of $V_C - V_A$ at which photo current just stops is called Stopping Potential (V_{sp}).

$eV_{sp} = KE_{max}$







Same metal, different Intensity