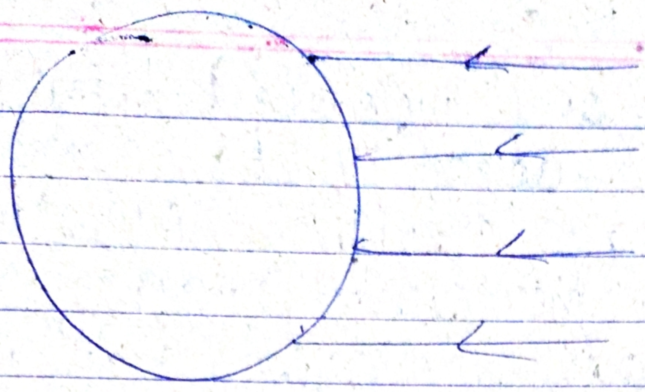
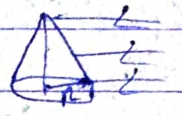


short trick

$$F = \frac{I}{c} \times \text{Projected area}$$

for any value of a and r



$F = \frac{I}{c} \cdot hr$

Photo electric effect ⇒

ϕ = work function $= \frac{hc}{\lambda_0} = \frac{12400}{\lambda}$ eV

E↑ λ↓ then at λ when e^- starts coming out is known as thershold wavelength (λ_0)

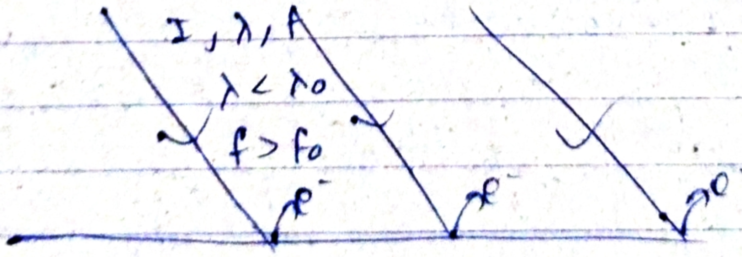
thersold frequency (ν_0)

experimental observation and conclusion ⇒

suppose we have taken a light of wavelenth λ and frequency f and we are not getting any electron from the surface. now we started increasing intensity of light keeping f and λ constant. we found that electron will no come out for any increasment value of intensity so we concluled that electrons का बाहर आना does not depend on intensity. now we started increasing frequencey or we can say starting decreasing wavelength. we found that at a particular value of f_0, and λ electron start coming out from the surface as we further increase ~~or decrease~~ frequencey or decrease wavelenth electron emission continues so we concluded that e का बाहर आना depends on frequencey and wavelenth.

<u>Thersald frequencey</u> ⇒ Min^m frequ. of light required for a particular surface to get electron is known as thersald frequencey of surface.

<u>Thersald λ</u> ⇒ Max^m possible value of λ for which electron will come out from the surface is known as thersald wavelenth (λ_0)



so we concludded that ejection of e^- depends on energey of one photon. (not on total energey) i.e. intensity) because process depends on h and λ

min^m energey of one Photon required to take out the e⁻ from the metal surface is k/a work function for that particular surface

* work function, Thresold frequence and thresold wavelength depends on metal surface and these values changes with changing the metal surface.

The process of ejection e⁻ from metal surface on incident of light (Photons) is k/a photoelectric ~~surface~~ effect.

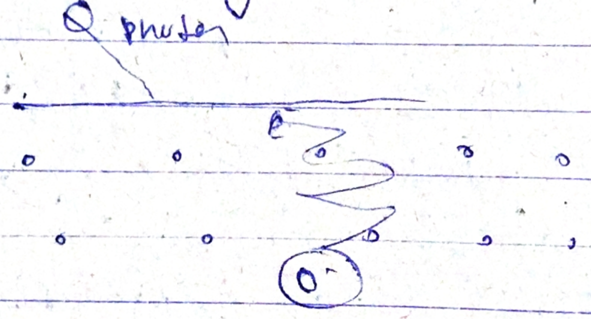
photoelectric effect can be explained only using particle nature of light (not by wave nature, if we consider wave nature then e for every intensity electron बाहर आने चाहिए थे पर experimentally ऐसा होता नही है (It is found that electron ejection is independent of intensity)

(ii) अगर हम wave ~~nature~~ nature माने तो electron को बाहर आने में कुछ समय लगना चाहिए कि electron emission is a instaneous process which can be explained only using particle nature

अगर हम wave nature मान ले तो electron का बाहर आना frequency और wavelength पर Depend नही करना चाहिए और intensity Depend होना है but experimentally इसका उल्टा होता है

लायक photons ≡ capabale of taking out electron
नालायक photons ≡ not " " " "

हमने पाया कि जितने लायक photons $\left(\frac{IA}{hc}\right)$ per second गिरते हैं उससे बहुत कम electron बाहर आते हैं $\left(\frac{i}{e}\right)$ इसका मतलब Max^m लायक photons waste हो जाते हैं only .2 and .1 % ही काम कर पाते हैं



photoelectric effect मे हम ये मानते है कि एक photon एक ही electron को energy दे सकता है and 1 electron 1 ही photon से ले सकता है जब 1 electron 1 लायक photon को लेता है तो वह हमेशा surface के पास हो यह जरुरी नही है surface तक पहुँचने तक वह कई electrons and particle से टकराता है। अगर surface तक पहुँचते -2 उसकी energy work function से ज्यादा बच जाए तो वह बाहर आता है otherwise धरा मे ही रह जाता है and probality of above event is very-very less that is why we get very less no of electrons ejected as compare to no. of लायक photons falling.

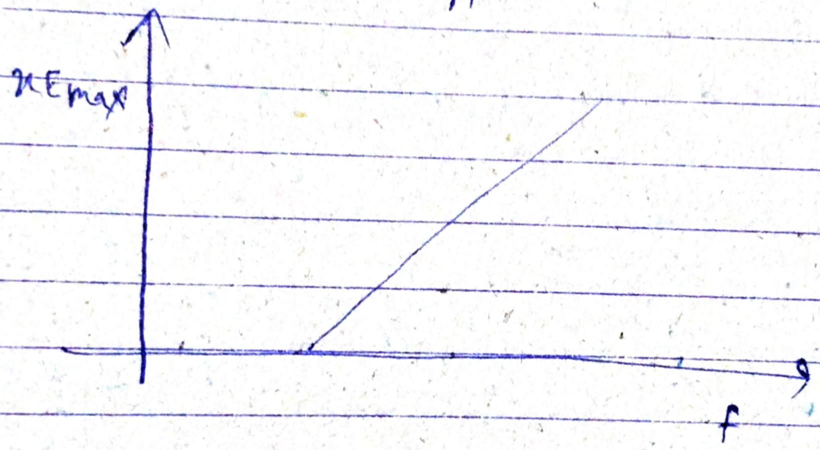
main eqn solving numerical problem

$$hf = hf_0 + KE_{max}$$

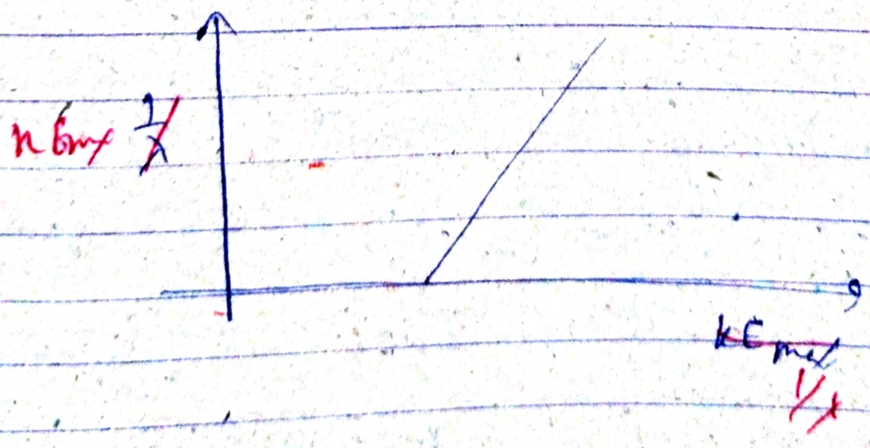
$$\frac{hc}{\lambda} = \frac{hc}{\lambda_0} + KE_{max}$$

$$hf = hf_0 + KE_{max}$$

$$f = \frac{KE_{max}}{h} + f_0$$

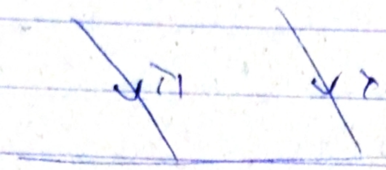


$$\frac{1}{\lambda} = \frac{KE_{max}}{hc} + \frac{1}{\lambda_0}$$



Ques 2 diff. wavelength λ_1 and λ_2 falls on a surface, ratio of max^m possible K.E is n, find ϕ (w.f.) of surface.

Ans



$$\frac{hc}{\lambda_1} = \phi + KE_{max\,1} \Rightarrow KE_{max\,1} = \frac{hc}{\lambda_1} - \phi$$

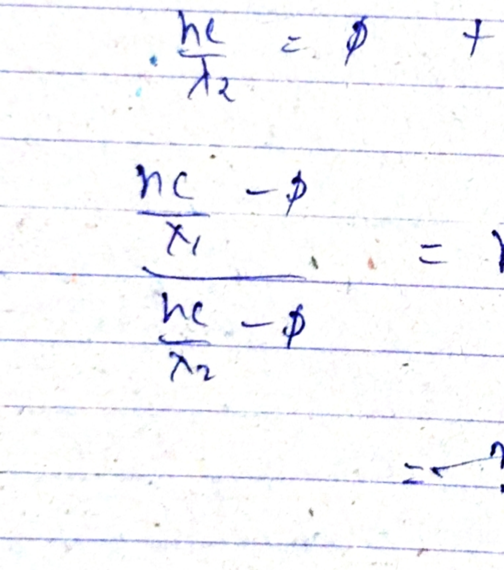
$$\frac{hc}{\lambda_2} = \phi + KE_{max\,2} \Rightarrow KE_{max\,2} = \frac{hc}{\lambda_2} - \phi$$

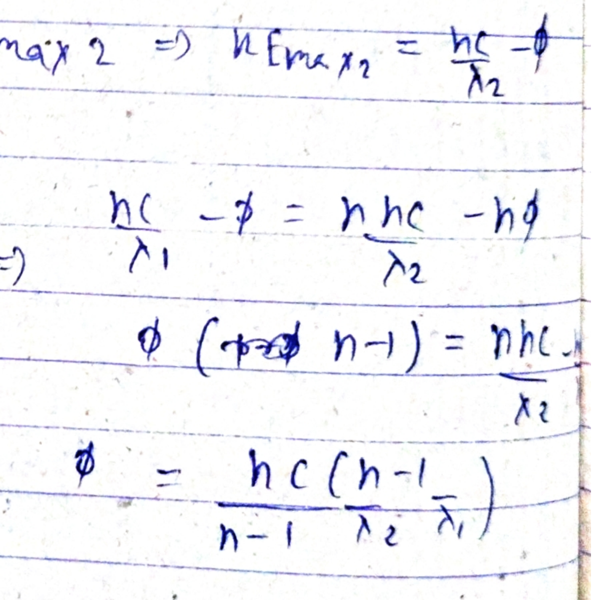
$$\frac{\frac{hc}{\lambda_1} - \phi}{\frac{hc}{\lambda_2} - \phi} = n \Rightarrow \frac{hc}{\lambda_1} - \phi = n\frac{hc}{\lambda_2} - n\phi$$

$$\phi(n-1) = \frac{nhc}{\lambda_2} - \dots$$

$$\phi = \frac{hc}{n-1}\left(\frac{n}{\lambda_2} - \frac{1}{\lambda_1}\right)$$

Ques





1. $K' = 2K$
2. $K' > 2K$ (✓)
3. $K' < 2K$
4. Depend on ϕ

$$hf = \phi + KE_{max}$$

$$KE_{max} = hf - \phi = K$$

$hf > K$

$$K' = 2hf - \phi$$

$$K' = hf + K$$

$$K' = 2.1K$$

Stopping Potensial & K.E max

अगर हम Potensial के magnitude को धीरे धीरे -ve side में बढ़ाएं तो हम पाएंगे कि current घट रहा है. मतलब electron reaching the other plate decreases. बढ़ाते रहने पर value ऐसी हो जाएगी potential की जिस पर current = 0 मतलब वह electron जो Max KE के साथ निकला था वह दूसरी plate पर Just पहुँचते रह जाएगा।

$$-eV + KE = 0 + 0$$

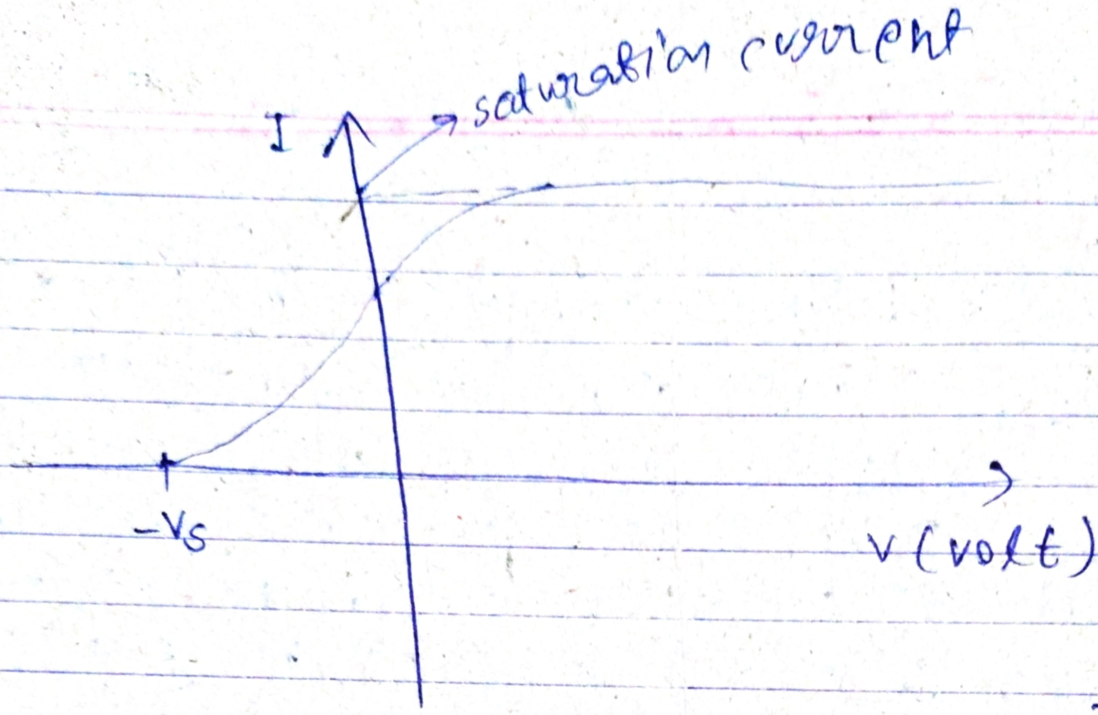
$$KE_{max} = eV$$

so we can say that maxm KE of electron ejected from surface is eV. where V is known as stopping potential. यदि किसी experiment में stopping potential given है तो मतलब KE_{max} given है।

eg stopping P.E = 4V $\Rightarrow$ $KE_{max} = 4eV$

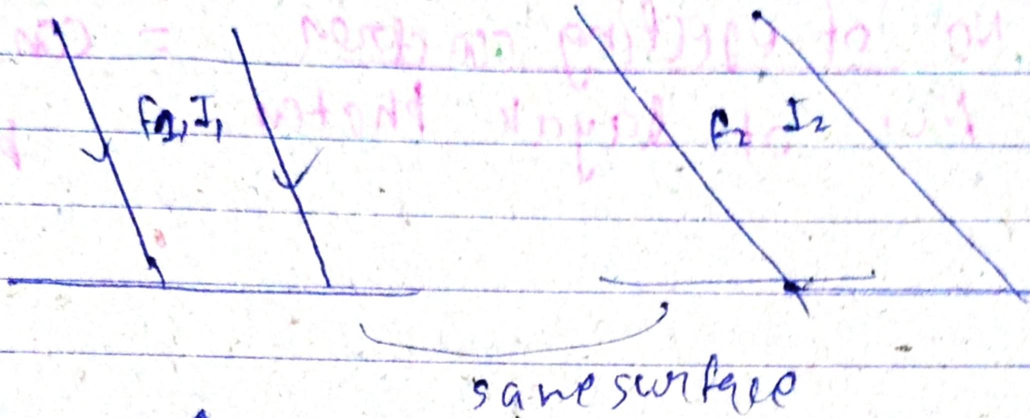
$$hf = hf_0 + eV_s$$

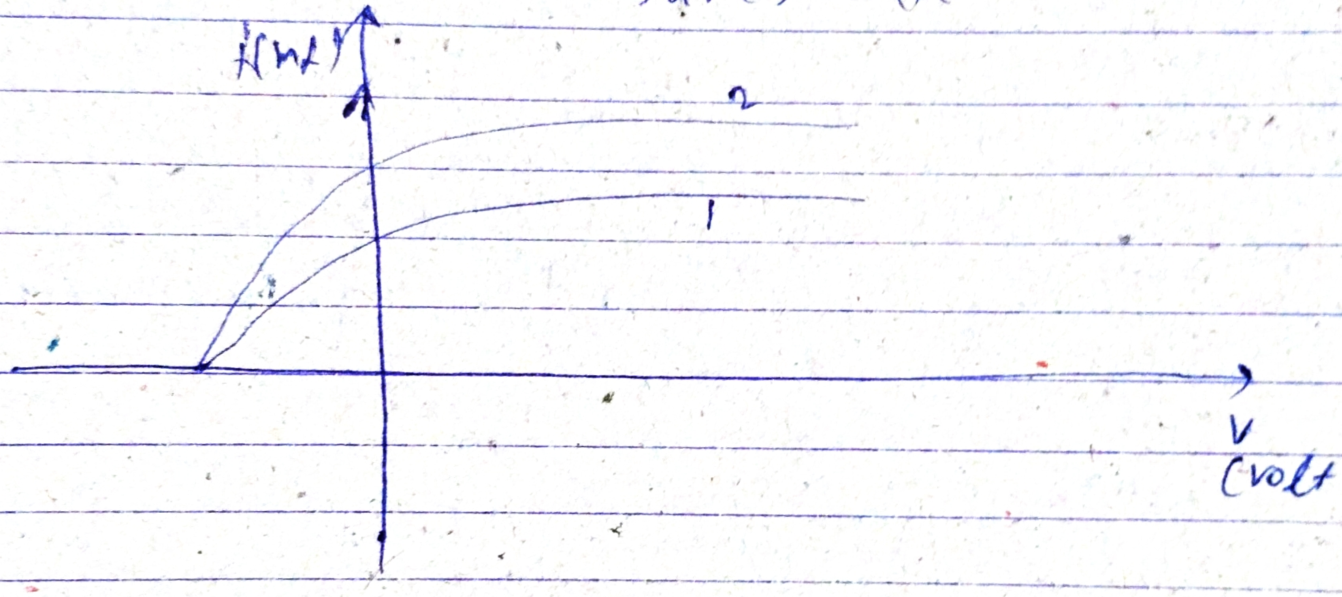
$$\frac{12400}{\lambda(A^\circ)} = \frac{12400}{\lambda_0(A^\circ)} + V_s$$



saturation current। अगर हम potential (+ve side) को बढ़ाए तो हमे देखते है कि current बढ़ने लगता है और a certain value के बाद potential जितना भी बढ़ाओ current बढ़ना बंद हो जाता है इस limiting value of current को saturation current कहते है। ऐसा इसलिए होता है (0 volt पर) जितने electron निकल रहे थे उनमे से कुछ other plate पर पहुंच रहे थे और कुछ नही पहुंच रहे थे जब हमने potential बढ़ाया तो धीरे-2 वह electron भी पहुंचने लगे जो नही पहुंच रहे थे ऐसा करके करके अब सारे electron दूसरे ~~Sur~~ plate पर पहुंचने लगे रहे थे उसके पास ~~जितने भी~~ electron ~~पर~~ जितना भी potential बढ़ाओ No. of electron reaching the other plate remain same और current become constant and that is known as saturation current

Qn





comment on f_1 & f_2	comment on I_1 and I_2
(a) $f_1 > f_2$	① $I_1 > I_2$
(b) $f_2 > f_1$	② $I_2 > I_1$ (✓)
(c) $f_1 = f_2$ (✓)	③ $I_1 = I_2$
(d) Not possible to comment ⟵	④

***** stopping potensial depends on frequency and wavelength of the incident light and work function

***** stopping potensial does not depend on intensity.

***** saturation current depends on intensity of light as intensity increase saturation current increases. (ऐसा में होता रहे है electron potential रहे है।)