

Q.1. Tungsten, atomic energy levels, $K \rightarrow 69.5 \text{ keV}$
 $L \rightarrow 11.3 \text{ keV}$
 $M \rightarrow 2.3 \text{ keV}$.

Find K_{β} & K_{α} lines.

Also find V_{\min} , λ_{\min} .

(Binding Energy)

$K_{\alpha} \rightarrow (69.5 - 11.3) \text{ keV}$

$$\lambda_{K_{\alpha}} = \frac{12400}{(69.5 - 11.3) \times 10^3} \text{ \AA}$$

$= 0.212 \text{ \AA}$



$$\lambda_{K_{\beta}} = \frac{12400}{(69.5 - 2.3) \times 10^3} \text{ \AA}$$

$V_{\min}^{\text{min}} \text{ volt} = 69.5 \text{ kV}$

$$\lambda_{\min} = \frac{12400}{69.5 \times 10^3}$$

Q.2

X-ray tube \rightarrow 20 kV.

An e^- loses 5% of its KE \rightarrow X-ray photon emitted
@ first collision.

Find λ photon.

$$\lambda = \frac{12400}{\left(\frac{5}{100}\right) \times 20 \times 10^3} \text{ \AA}$$

Q.3.

X-ray tube @ 40 kV.

& e^- current $\rightarrow 10 \text{ mA}$.

Assume 1% eff.

① Total power carried by X-rays.

② How much heat is produced per sec.

4W

$$\text{power incident} = 40 \times 10^3 \times 10 \times 10^{-3} \text{ W}$$

$$= 400 \text{ W.}$$

396 W.

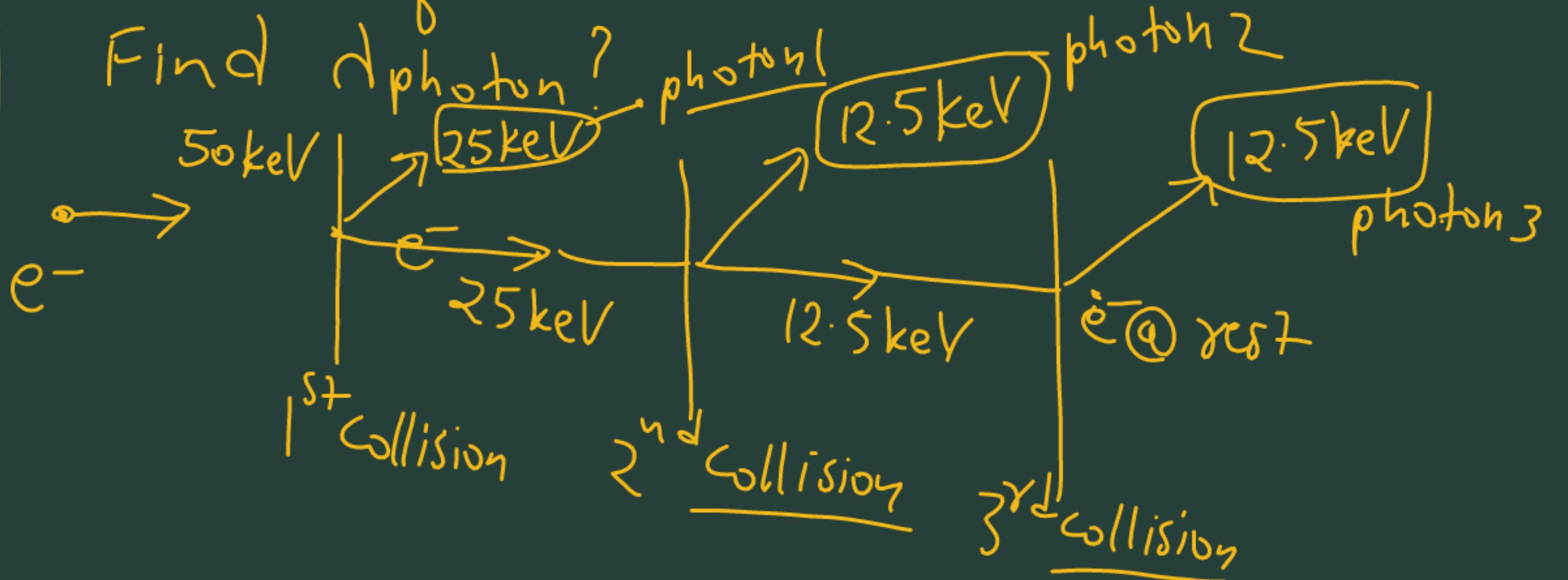
Q.4. $\Delta V \rightarrow 50 \text{ kV}$

$e^- \rightarrow$ three collisions \rightarrow comes to rest.

loses half of its remaining KE
in each of the first two collisions.

Find λ photon?

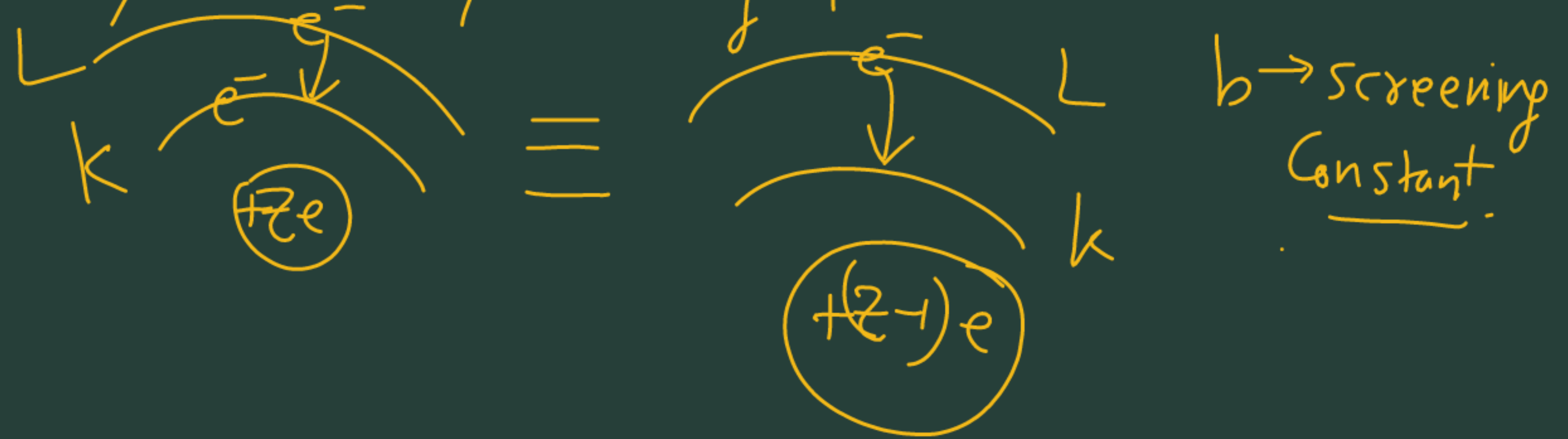
$$\lambda_1 = \frac{12400}{25 \times 10^3} \text{ \AA}$$
$$\lambda_3 = \lambda_2 = \frac{12400}{12.5 \times 10^3} \text{ \AA}$$



Screening Effect

① When an electron corresponding to $K\alpha$ transition, transits from L shell to K shell, it experiences

barriers/repulsion/screening from K shell e^- .



Moseley's Law Questions

Q.1. λ of K_{α} for Mo ($Z=42$) = 0.71 \AA .

Find λ of K_{α} for Cu ($Z=29$) = ?

$$\sqrt{\frac{\lambda_2}{\lambda_1}} = \frac{41}{28}$$

$$\lambda_2 = 0.71 \times \left(\frac{41}{28}\right)^2$$

$\sqrt{\quad}$
A.

$$\sqrt{\nu} = a(z-b)$$

$$\sqrt{\frac{c}{\lambda_1}} = a(42-1) \rightarrow \text{for Mo.}$$

$$\sqrt{\frac{c}{\lambda_2}} = a(29-1) \rightarrow \text{for Cu}$$

$$b=1 \text{ for } K_{\alpha}$$

Solve for λ_2

Physics Syllabus

