JEE MAIN

MODERN PHYSICS – PART 2

FORMULAE

PHOTOELECTRIC EFFECT

Now that's how you REVISE

-Mohit Goenka, IIT Kharagpur

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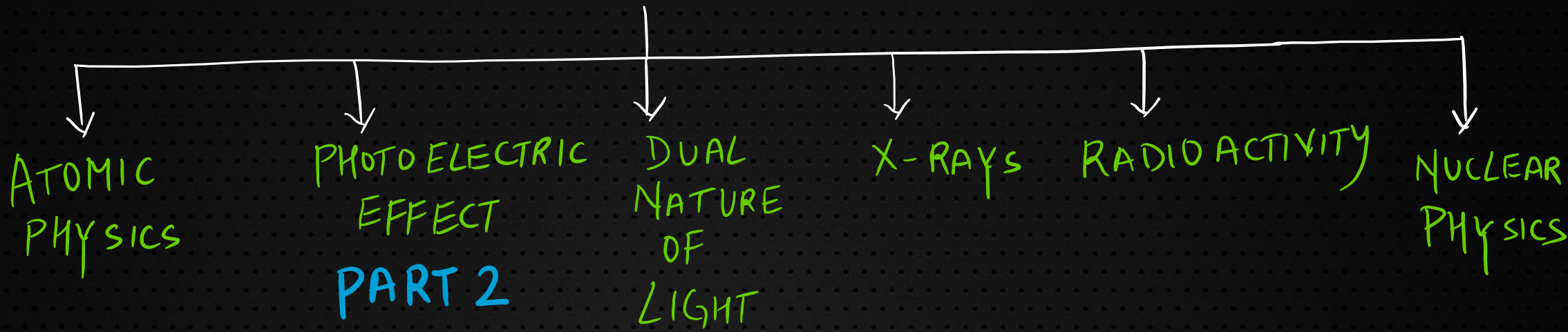
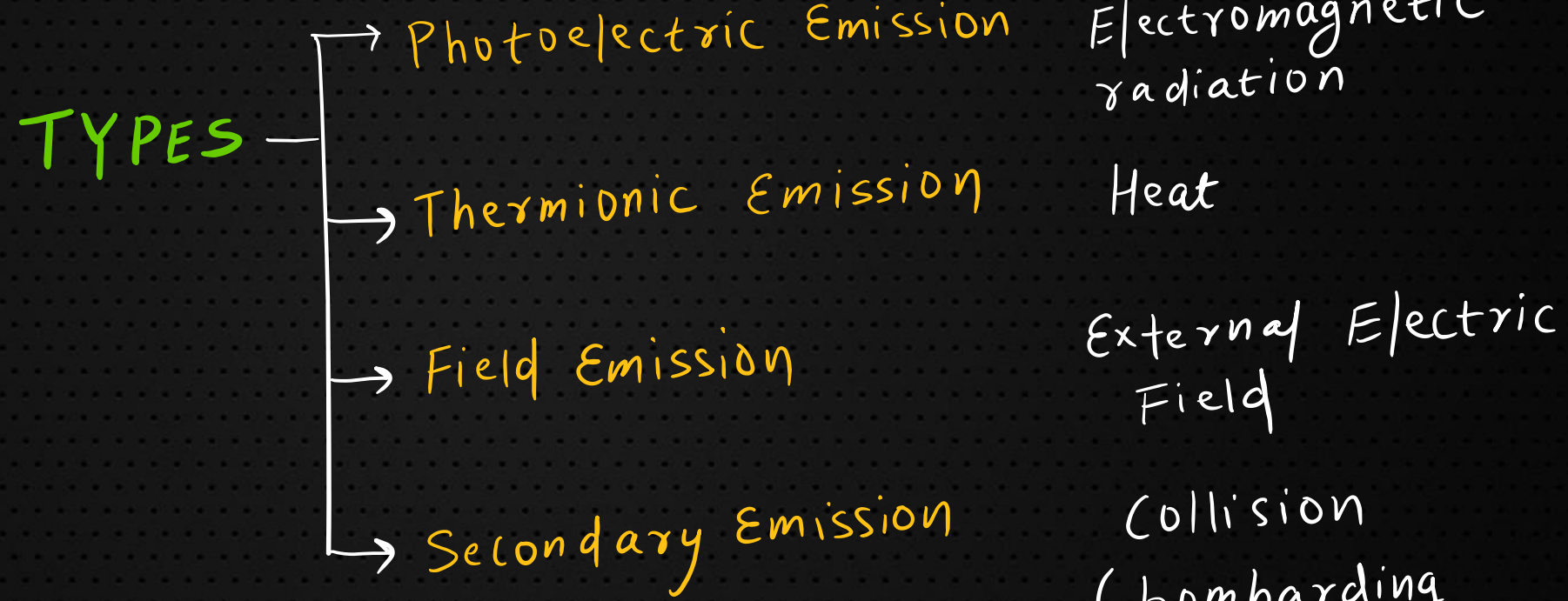
MODERN PHYSICS

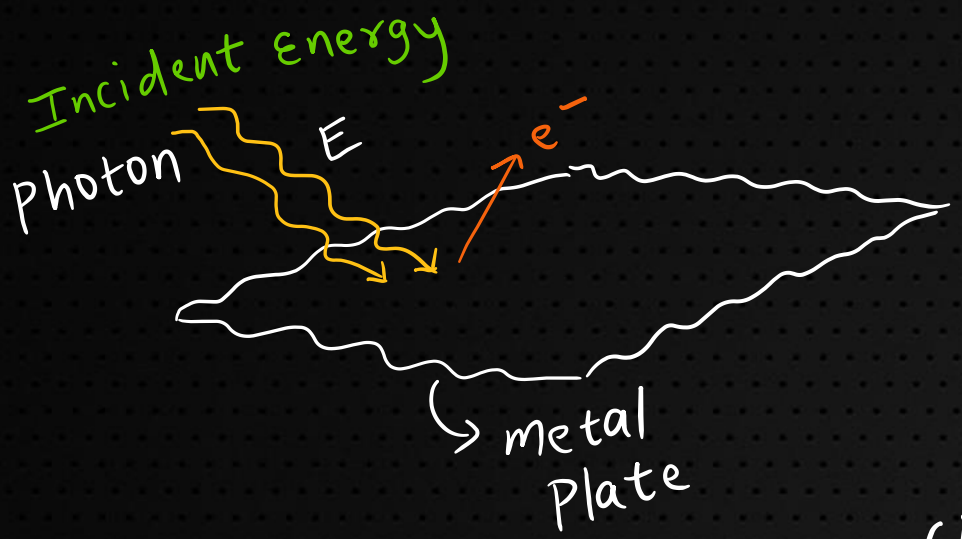


1. ELECTRON EMISSION

↳ Work function, ϕ (Minimum energy required to eject e^- from metal surface)



2. PHOTOELECTRIC EMISSION



(a) Threshold frequency (ν_{th}), Threshold Wavelength (λ_{th})

$$\phi = h\nu_{th} = \frac{hc}{\lambda_{th}}$$

ν_{th}: minimum freq. to start photoelectric effect.

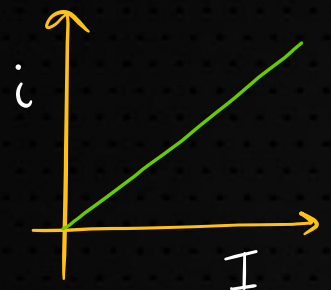
(b) If $\nu > \nu_{th}$ $(E > \phi)$

e^- comes out with Vmax, $\frac{1}{2}mv_{max}^2 = E - \phi$

$$\Rightarrow K_{max} = h\nu - h\nu_{th}$$

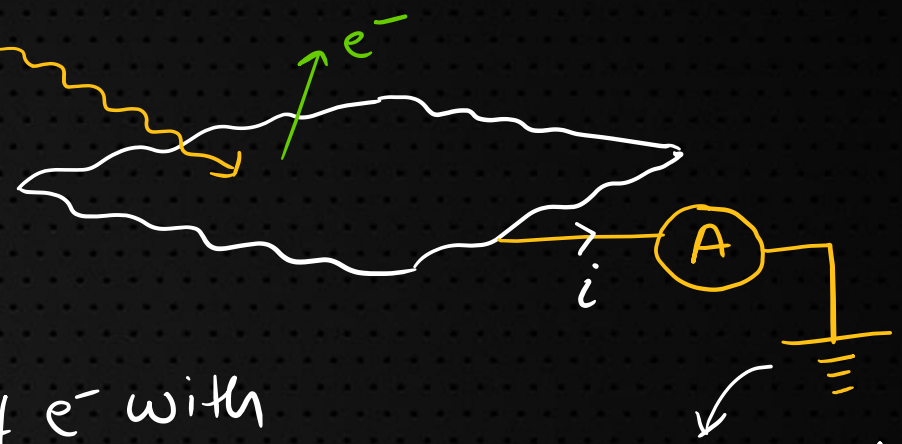
NOTE: e^- may come out with $V < V_{max}$ if it collides with other e^-.

3. EFFECT OF INTENSITY (I) and TEMP° (T) ON PHOTOELECTRIC EFFECT



(a) If I ↑ ⇒ i also ↑

(b) If Temp° ↑ ⇒ No effect



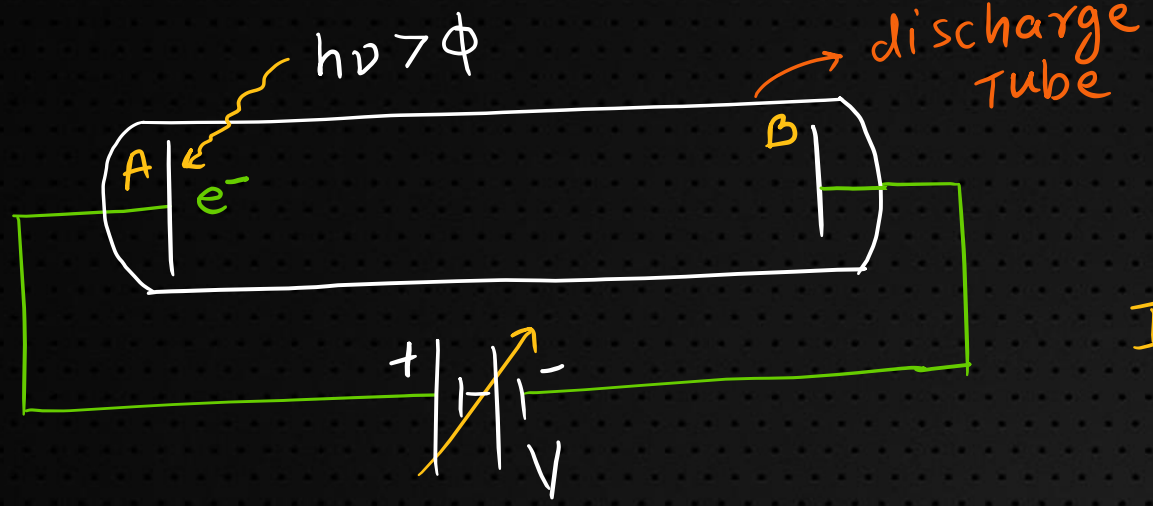
NOTE: ↑ I doesn't ↑ K.E of e⁻ with which it comes out.

$$[K = h\nu - \phi]$$

K depends on ν of incident energy.

Grounded to keep plate neutral.

4. STOPPING POTENTIAL



(a) e^- with V_{max} moves to B

(b) Battery does −ve work

(c) so energy at B = $K_{max} - eV$

If for a $V = V_0$, $K_{max} - eV_0 = 0$

$\Rightarrow V_0$ is stopping potential

$\therefore \boxed{eV_0 = K_{max}}$

(d) $V_0 = \frac{K_{max}}{e} = \frac{E - \Phi}{e} = \frac{h\nu}{e} - \frac{h\nu_{th}}{e}$

$$\boxed{V_0 = \frac{h}{e}\nu - \frac{h\nu_{th}}{e}}$$

Einstein Photoelectric equation