VIDYAPEETH

BATCH CODE: 19-PJ301EA 2025

SUBJECT NAME: CHEMISTRY

CHAPTER NAME:

Atomic Structure

Lecture No. 03

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Today's Goal

Subtopic

Plank's Theory

Photo electric Effect

Black Body Radiation →

Plank's hypothesis ⇒ - Radiation in the form of Quanta

- each Quanta has fixed energy
- Energy of Quanta $\propto$ frequency of radiation $\propto \frac{1}{\text{wavelength of radi}}$

→ Energy in the form of bundles

→ $E \propto \nu$ $\quad \nu$ = frequency of radiation $\quad \boxed{\nu = \frac{c}{\lambda}}$

✓ $\boxed{E = h\nu} = \boxed{\frac{hc}{\lambda}}$

$h\nu$, $2h\nu$, $3h\nu$, $4h\nu$, ---

Quanta received from sun

$\boxed{\text{Photon}}$

$\cancel{1.2h\nu}$

Energy of Photon = $\boxed{E = h\nu = \frac{hc}{\lambda}}$

h = universal plank constant.

$= 6.6 \times 10^{-34}$ J-Sec.

$\Rightarrow \quad J = \frac{h \times \cancel{Hz}\ \text{sec}}{\cancel{m}}$

$\boxed{h = \text{J-Sec.}}$

$\boxed{E_n = -K \cdot \frac{Z^2}{n^2}}$ for H-like atom

Electron transition

$(n_2 > n_1)$

ΔE absorbed

$$n_1 \longrightarrow n_2$$

$$E_{n_1} = -K \cdot \frac{Z^2}{n_1^2}$$

$$E_{n_2} = -K \cdot \frac{Z^2}{n_2^2}$$

$$\Rightarrow \boxed{E_{n_2} - E_{n_1} = KZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)} = \Delta E$$

ΔE radiated.

$$n_2 \longrightarrow n_1$$

Energy radiated in the form of Quant

$$\boxed{\Delta E = h\nu = \frac{hc}{\lambda}}$$

λ = wavelength {human eye} $\rightarrow$ Visible region

$$\Delta E = K \cdot Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

$$\frac{hc}{\lambda} = K \cdot Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$$

$$\Rightarrow \boxed{\frac{1}{\lambda} = \left(\frac{K}{hc}\right) \cdot Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]}$$

{Spectrum}

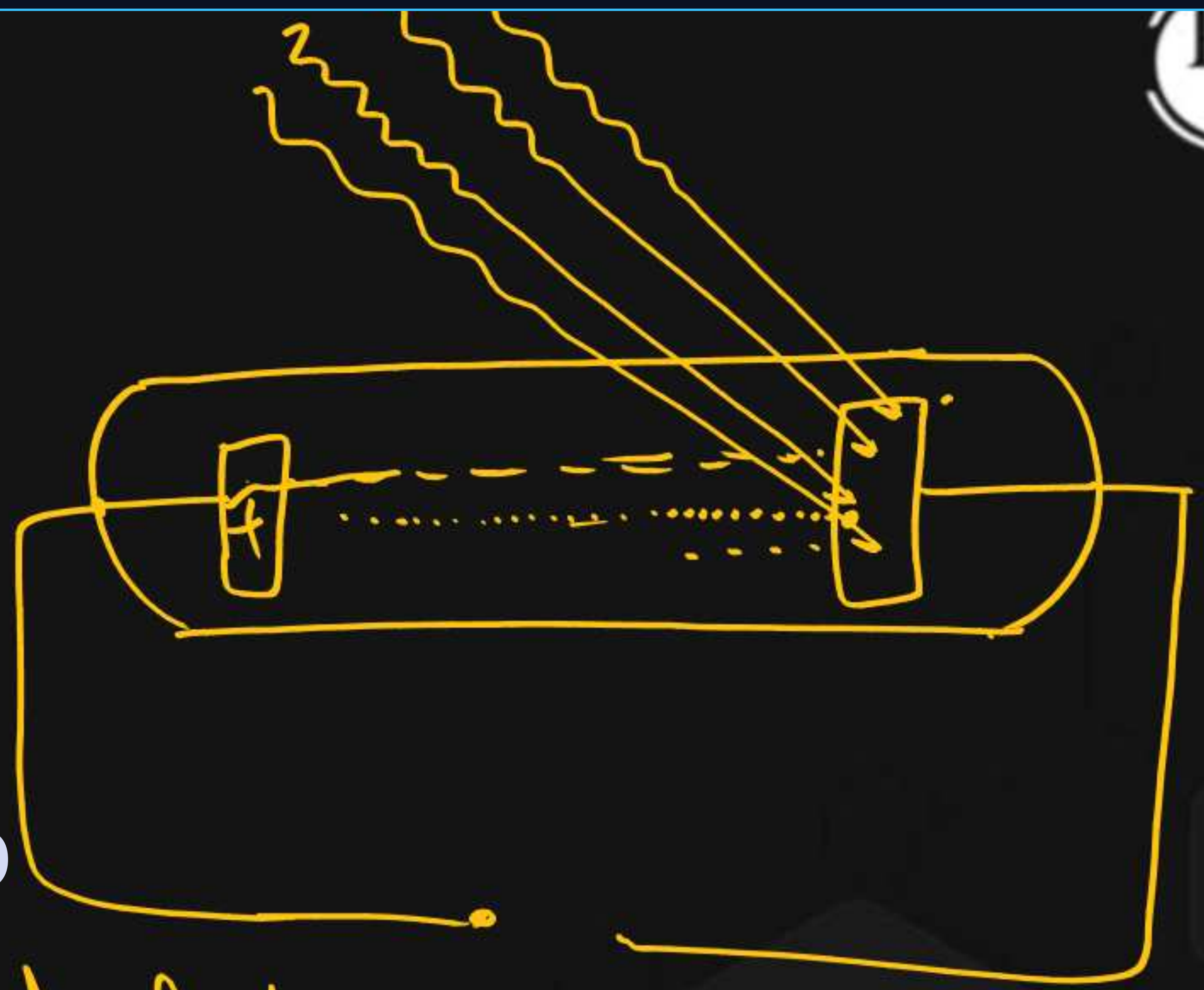
Photo electric Effect :-

Threshold energy (E_0) → ϕ {work function}

Energy of incident radiation (E)

→ $E < E_0$; no photoelectric effect

→ $E > E_0$; photo electric effect.



⇒ maximum Kinetic energy of emitted photo electron $= E - E_0$

$$\Rightarrow \boxed{\frac{1}{2}mv^2_{max.} = E - E_0}$$

According Planks theory

$$\Rightarrow \boxed{\frac{1}{2}mv_{max.}^2 = h\nu - h\nu_0}$$

$$\Rightarrow \boxed{\frac{1}{2}mv_{max}^2 = \frac{hc}{\lambda} - \frac{hc}{\lambda_0}}$$

ν_0 = Threshold frequency

λ_0 = Threshold wavelength

ν = frequency of incident radiation

λ = Wavelength of Incident radiation.

Stopping potential $\rightarrow V_0$

$$eV_0 = (K.E)_{max.}$$

$$\Rightarrow eV_0 = h\nu - h\nu_0$$

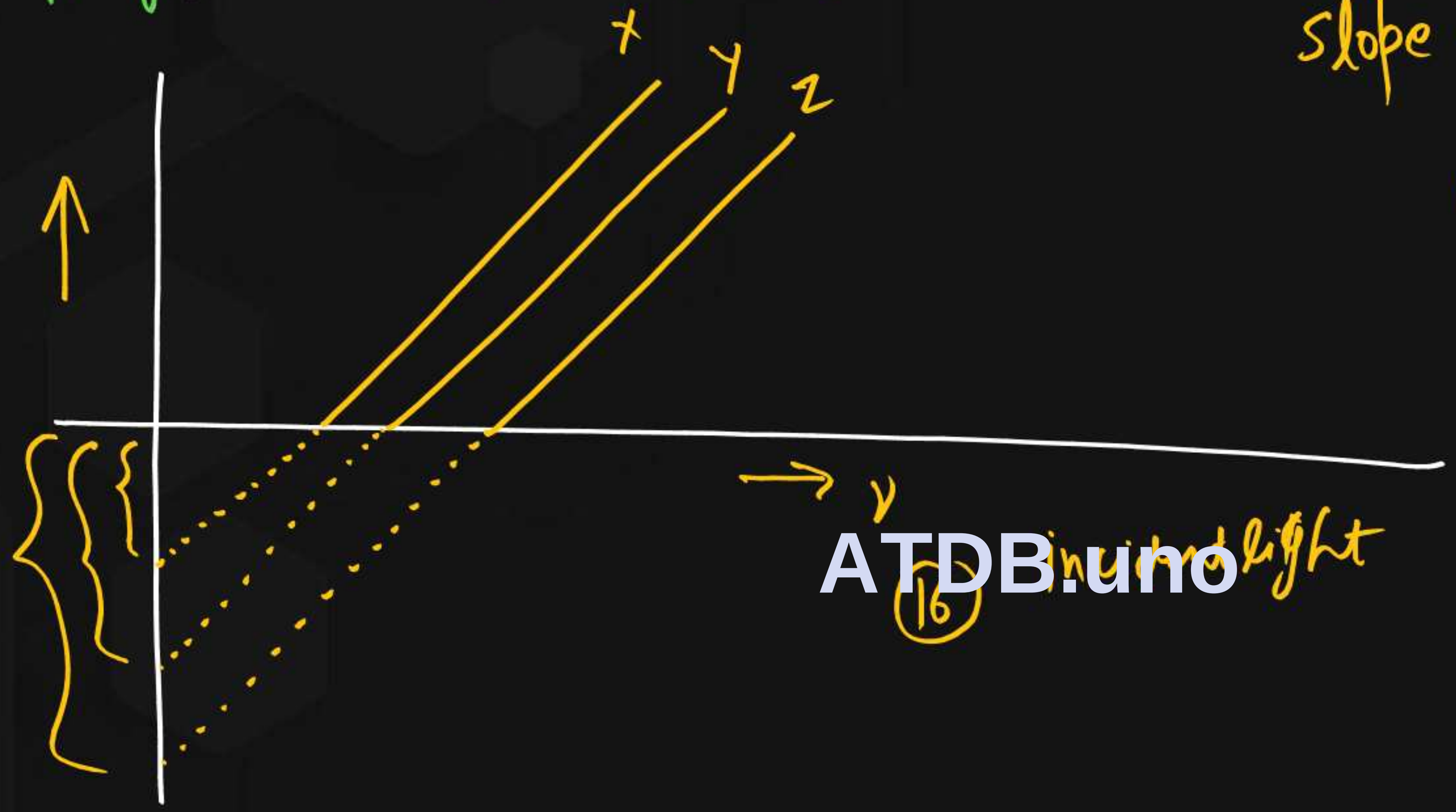
$$\Rightarrow eV_0 = hc\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right)$$

$$eV_0 = h\nu - h\nu_0$$

$$\Rightarrow V_0 = \left(\frac{h}{e}\right)\cdot\nu - \frac{h\nu_0}{e}$$

$$Y = mX + C$$

Stopping potential V/S frequency of incident radiation



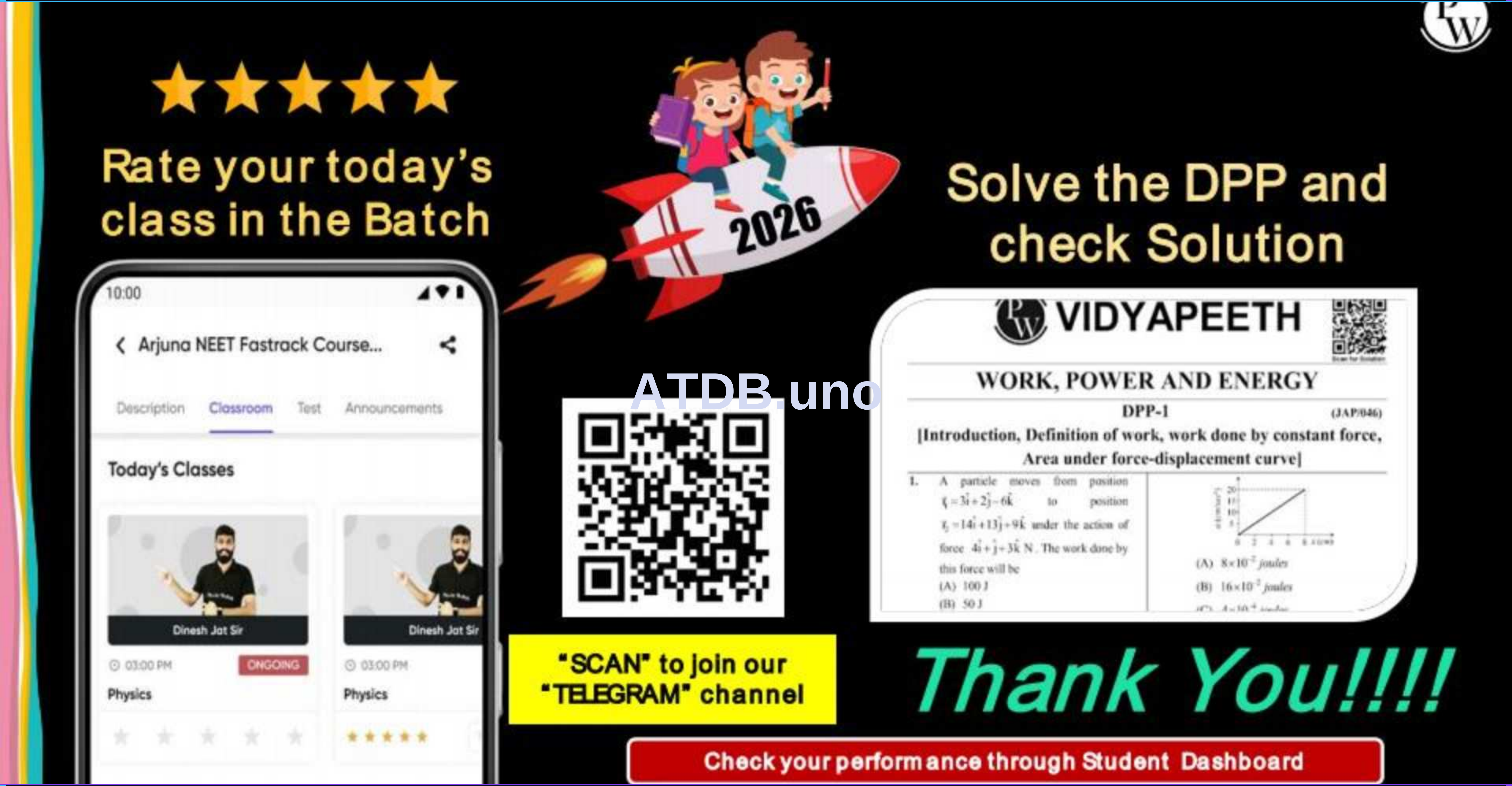
Slope = $\frac{h}{e}$ (constant)

Work function
↳ intercept on Y axis

deeper more

(16) incident light electro

$$\boxed{K.E_0 = h\nu - h\nu_0}$$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