

VIDYAPEETH



BATCH CODE: 19-PJ301EA 2025

SUBJECT NAME: CHEMISTRY

CHAPTER NAME:
Atomic Structure

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Lecture No.

03

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Today's Goal

Subtopic

Plank's Theory

Photo electric effect

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Black Body Radiation



Plank's hypothesis \Rightarrow Radiation in the form of Quanta

- each Quanta has fixed energy

- Energy of Quanta \propto frequency of radiation $\propto \frac{1}{\text{wave length of radi}}$

\rightarrow Energy in the form of bundles

$\rightarrow E \propto \nu$ $\nu = \text{frequency of radiation}$

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

$$\nu = \frac{c}{\lambda}$$

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

Quanta received from sun

Photon

~~$1.2h\nu$~~

$$\text{Energy of photon} = E = h\nu = \frac{hc}{\lambda}$$

$$h = \text{universal plank constant} \\ = 6.6 \times 10^{-34} \text{ J-sec}$$

$$J = \frac{h \times \cancel{\text{m/sec}}}{\cancel{\text{m}}}$$

$$h = \text{J-sec}$$



$E_n = -k \cdot \frac{z^2}{n^2}$ for H-like atom

$$(n_2 > n_1)$$

Electron transition

ΔE absorbed

$$n_1 \longrightarrow n_2$$

ΔE radiated.

$$n_2 \longrightarrow n_1$$

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Energy radiated in the form of Quant

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

$$E_{n_1} = -k \cdot \frac{z^2}{n_1^2}$$

$$E_{n_2} = -k \cdot \frac{z^2}{n_2^2}$$

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

λ = wavelength { human eye } \rightarrow Visible region \checkmark $\xrightarrow{500}$

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

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

{ Spectrum }

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

Photo electric effect : ϕ (work function)

Threshold energy (E_0)

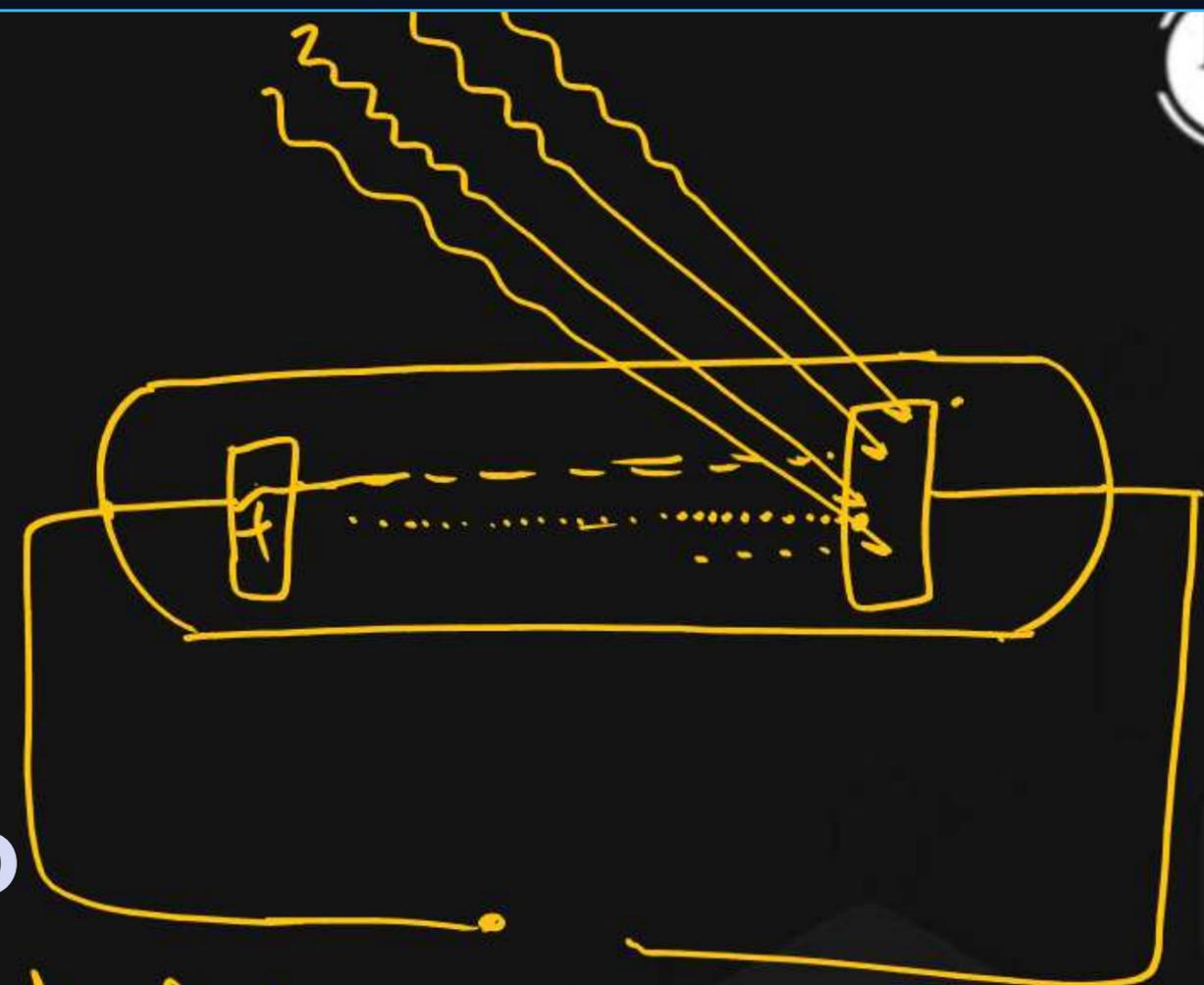
Energy of incident radiation (E)

$\rightarrow E < E_0$; no photoelectric effect

$\rightarrow E > E_0$; photo electric effect

\Rightarrow maximum kinetic energy of emitted photo electron = $E - E_0$

$$\Rightarrow \boxed{\frac{1}{2} m v_{\max}^2 = E - E_0}$$



According to Plank's theory

$\nu_0 =$ Threshold frequency

$\lambda_0 =$ Threshold wavelength

$\nu =$ frequency of incident radiation

$\lambda =$ Wavelength of incident radiation.



$$\Rightarrow \frac{1}{2} m v_{\max}^2 = h\nu - h\nu_0$$

$$\Rightarrow \frac{1}{2} m v_{\max}^2 = \frac{hc}{\lambda} - \frac{hc}{\lambda_0}$$

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Stopping potential ν_0

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

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

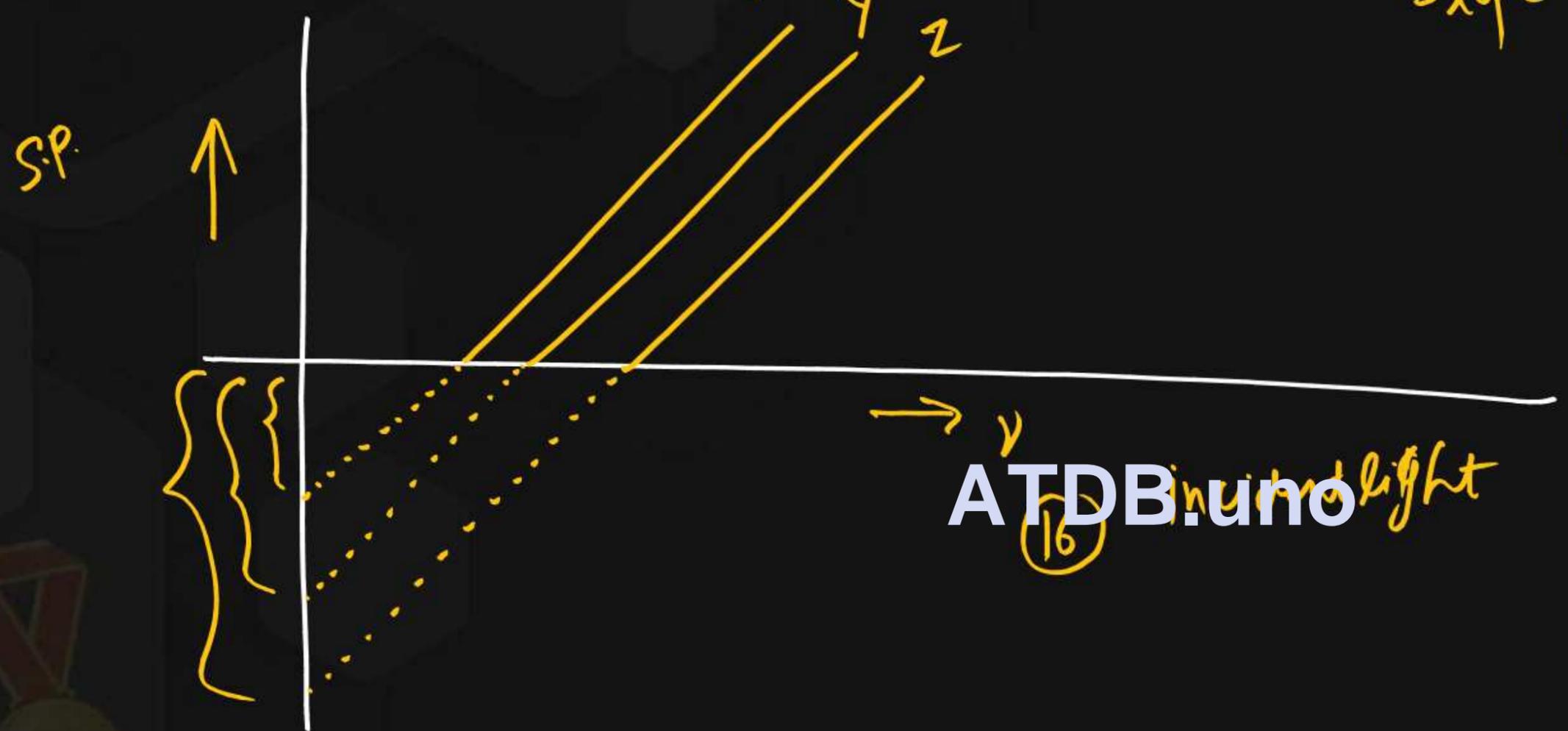
$$\Rightarrow eV_0 = hc \left(\frac{1}{\lambda} - \frac{1}{\lambda_0} \right)$$

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

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

$$\nu = m\lambda + c$$

Stopping potential v/s frequency of incident radiation



$$\text{slope} = \frac{h}{e} \text{ (constant)}$$

Work function
 ↳ intercep on y axis
 deeper more

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 (16)



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

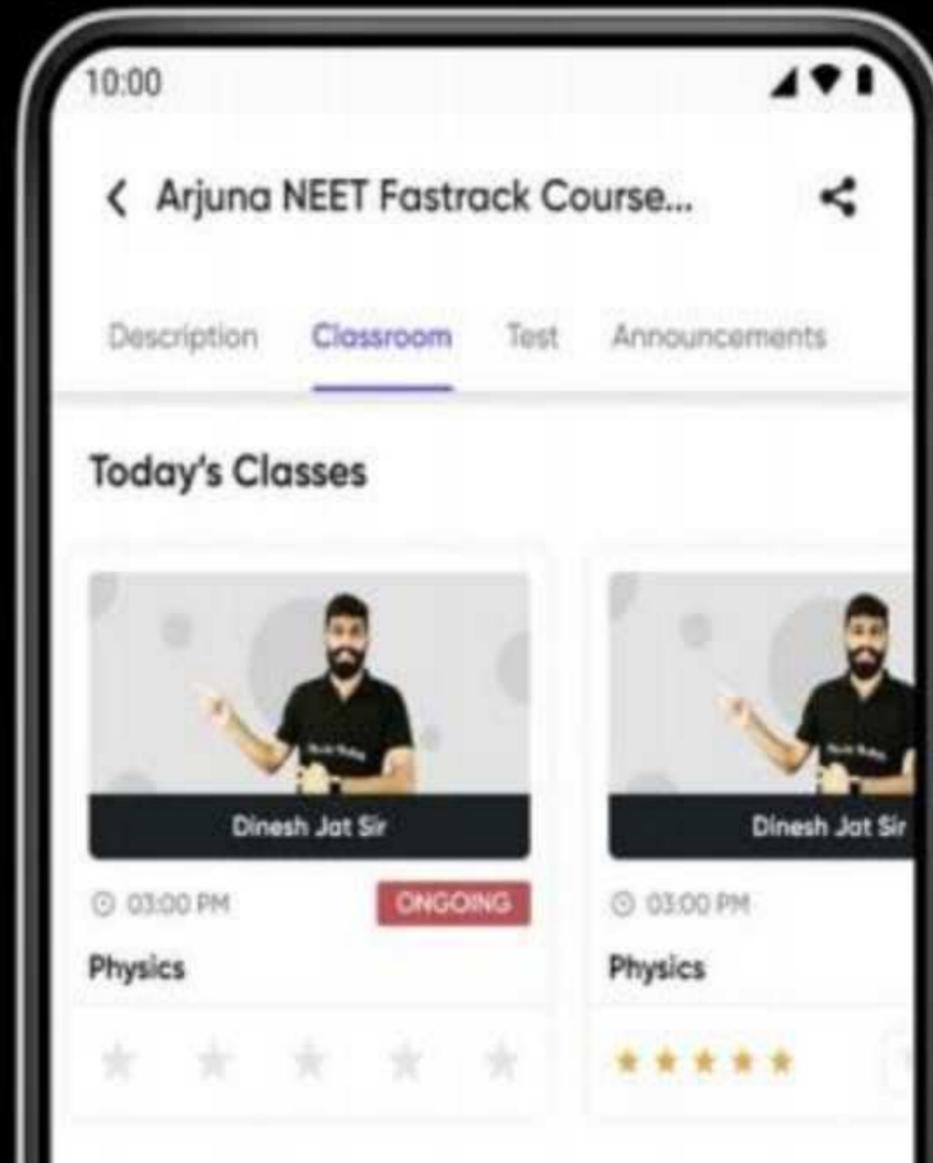
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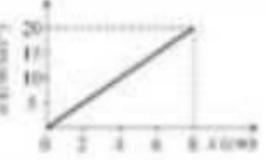
WORK, POWER AND ENERGY

DPP-1 (JAP/046)

[Introduction, Definition of work, work done by constant force, Area under force-displacement curve]

1. A particle moves from position $\vec{x}_1 = 3\hat{i} + 2\hat{j} - 6\hat{k}$ to position $\vec{x}_2 = 14\hat{i} + 13\hat{j} + 9\hat{k}$ under the action of force $-4\hat{i} + \hat{j} + 3\hat{k}$ N. The work done by this force will be

(A) 100 J
(B) 50 J



(A) 8×10^{-2} joules
(B) 16×10^{-2} joules
(C) 4×10^{-4} joules

Thank You!!!!

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