Doubt Clearing Session

Course on Atomic Structure for Class XI

akhilesh • Lesson 4 • Aug 29, 2021

Planck's quantum theory :→

$$E = \frac{hc}{\lambda} = \frac{1240\ nm.eV}{\lambda} = h\nu$$

$$h = 6.62 \times 10^{-34}\ J\ sec$$

Electrostatic force

$$\boxed{|F| = \frac{K q_1 q_2}{r^2}}$$

Coulombs law.

$K = 9 \times 10^9$

$$\text{Gravitational force} = \frac{G m_1 m_2}{r^2}$$

$$\left|\text{Electrostatic potential Energy}\right| = \frac{K q_1 q_2}{r}$$

$$\text{work done} = \Delta PE = -\int_{\infty}^{r} F \cdot dr$$

$$= \int_{\infty}^{r} \frac{K q_1 q_2}{r^2}\, dr$$

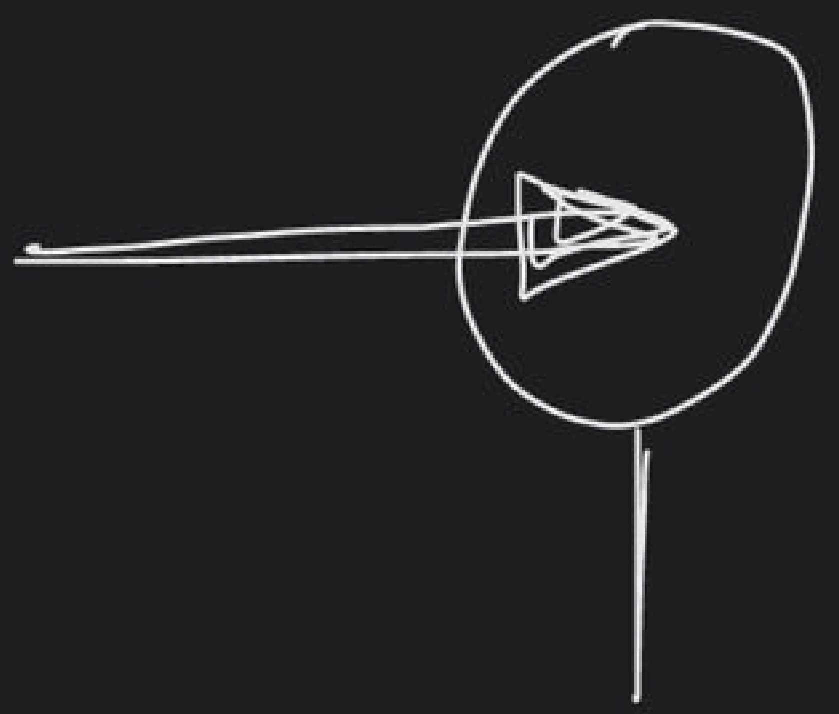
$$|\Delta PE| = \left[\frac{Kq_1q_2}{r}\right]_{\infty}^{r}$$

$$|PE_r| - \cancelto{0}{|PE_\infty|} = \frac{Kq_1q_2}{r}$$

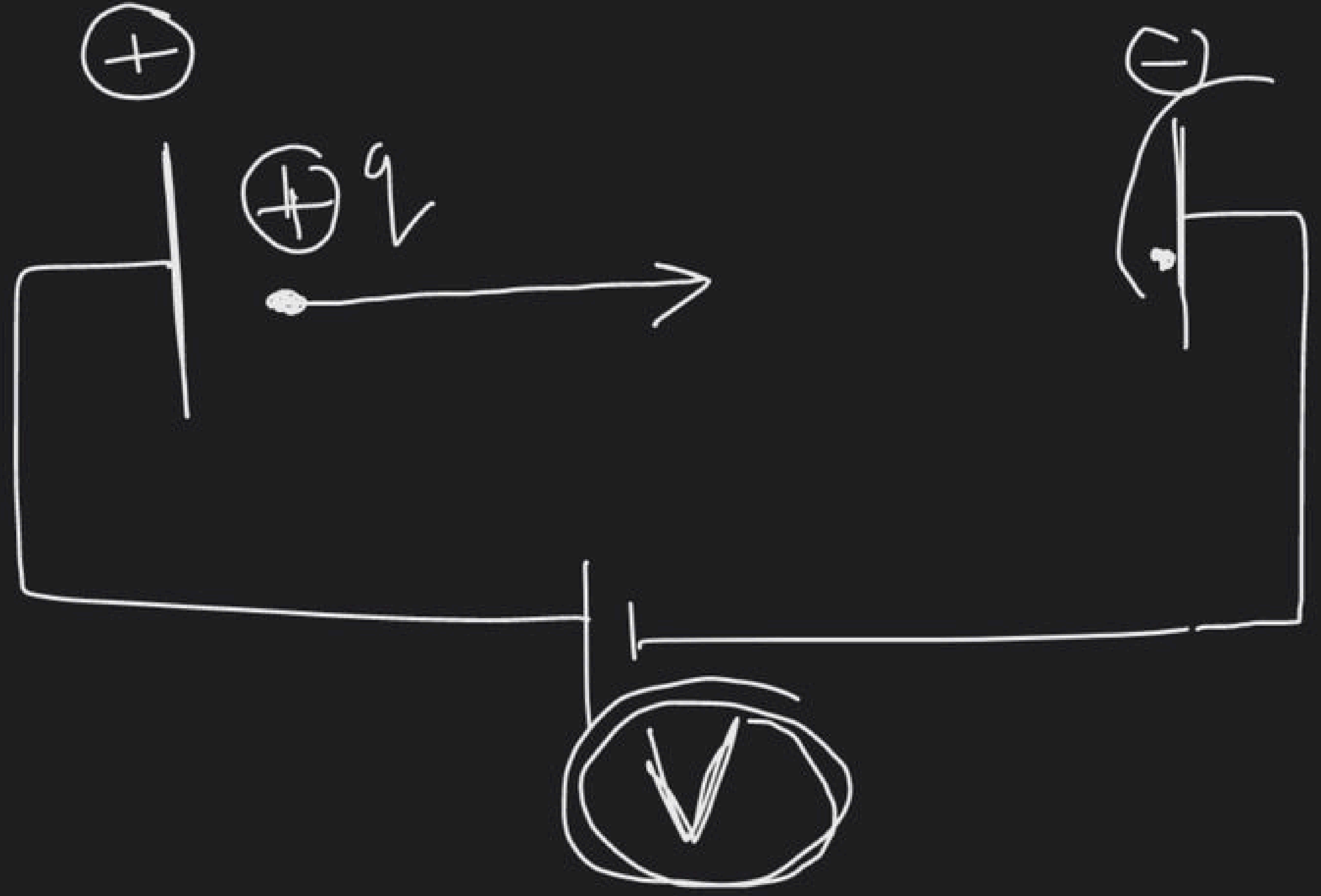
$$|PE|_r = \frac{Kq_1q_2}{r} +$$

$$U_r = \frac{Kq_1q_2}{r} + \cancel{U_\infty}$$

$1\,cal = 4.18\,J \simeq 4.2\,J$



$1\,eV = 1.6 \times 10^{-19}\,J$



$$\boxed{\Delta KE = qV}$$

1.6×10^{-19}

angular momentum = mvr $\underline{mv}$

Bohr Model :→ This model is based

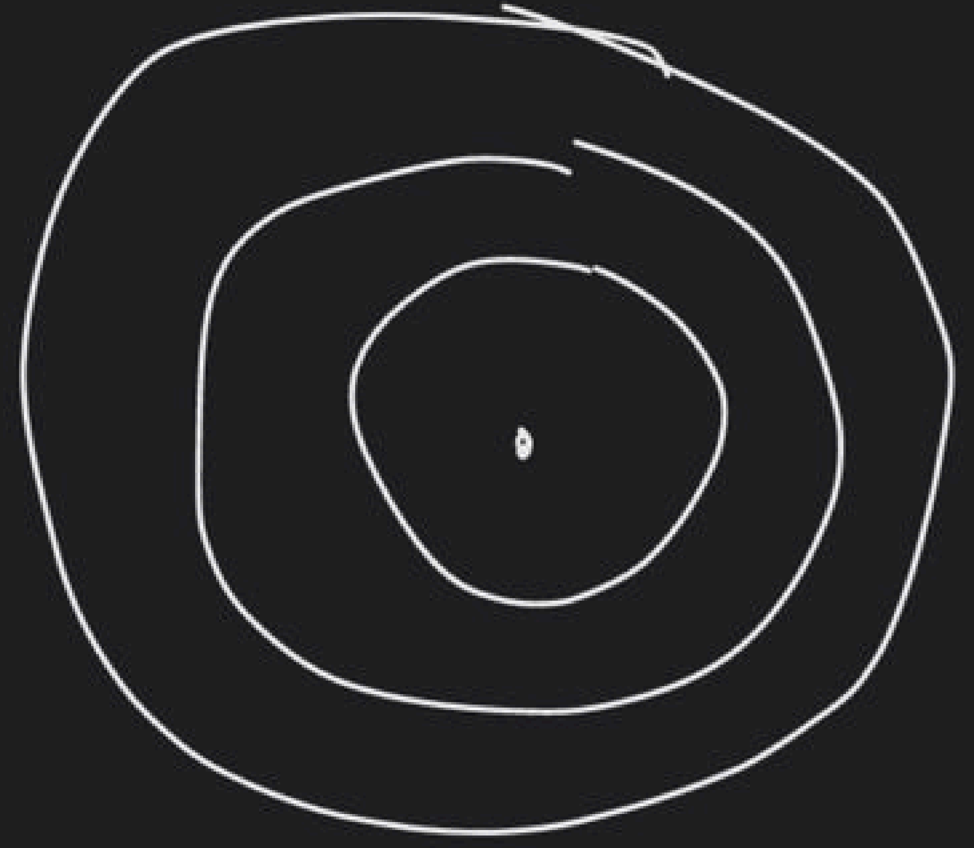
Plancks quantum theory & Rutherford Model. Postulates of Bohr Model

① In an atom e^-s revolve around the nucleus in circular path called orbits.

② Electrostatic force

provides the required centripetal force for circular motion.

(3) Out of infinite no. of orbits, e^- can revolve in only those orbits in which angular momentum is integral multiple of $\frac{h}{2\pi}$.



$$m v r = n \frac{h}{2\pi} \qquad n = 1, 2, \ldots$$

quantization of angular momentum.

or

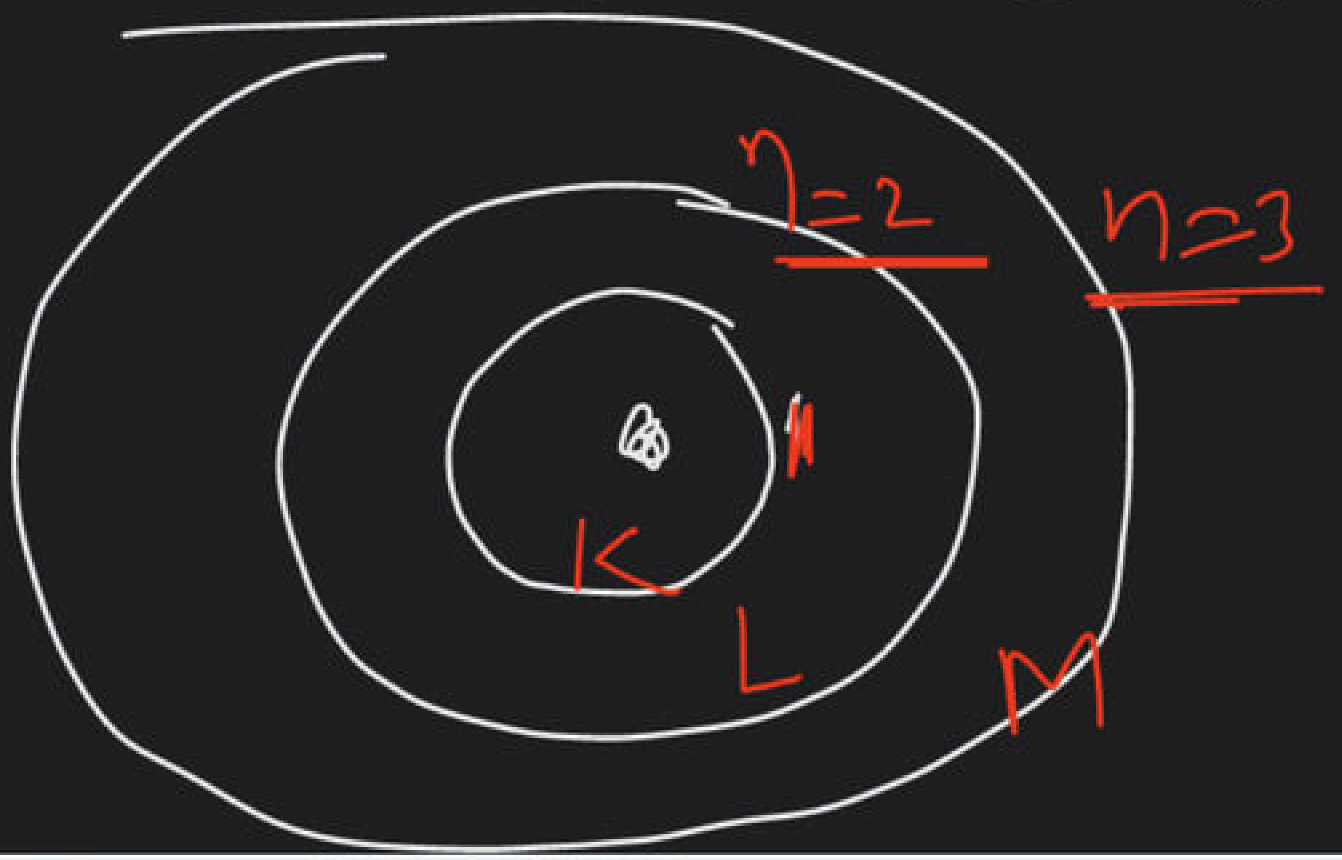
Bohr's quatization rule.

These orbits are known as

<u>stationary orbits.</u>

(4) An e^- neither emits nor absorbs energy while revolving in a stationary orbit.

(5) Energy of orbits increases as we move away from nucleus.



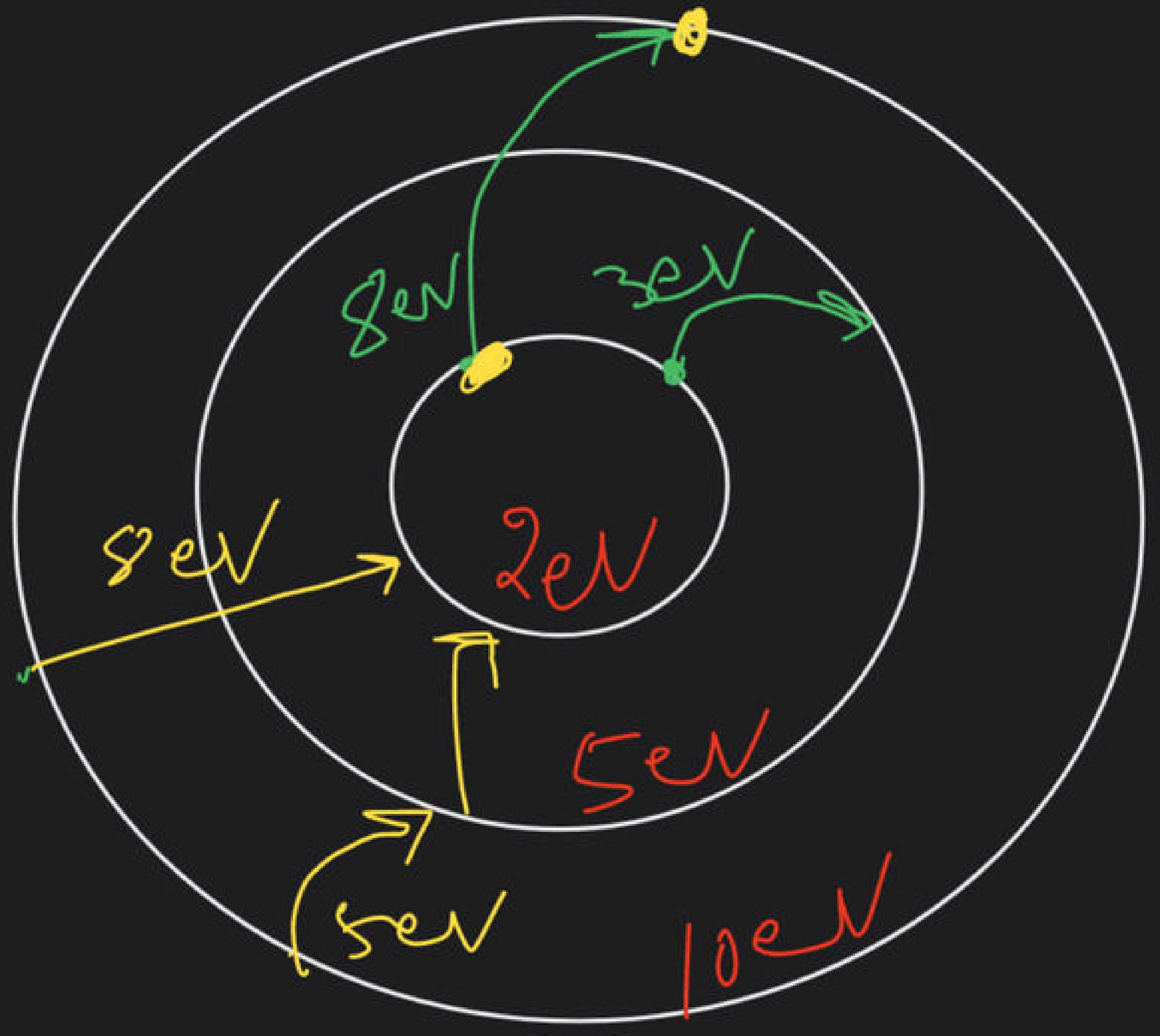
$E_K < E_L < E_M < E_N$

Shell

6. A photon is emitted or absorbed only when an e^- jumps from one stationary orbit to other

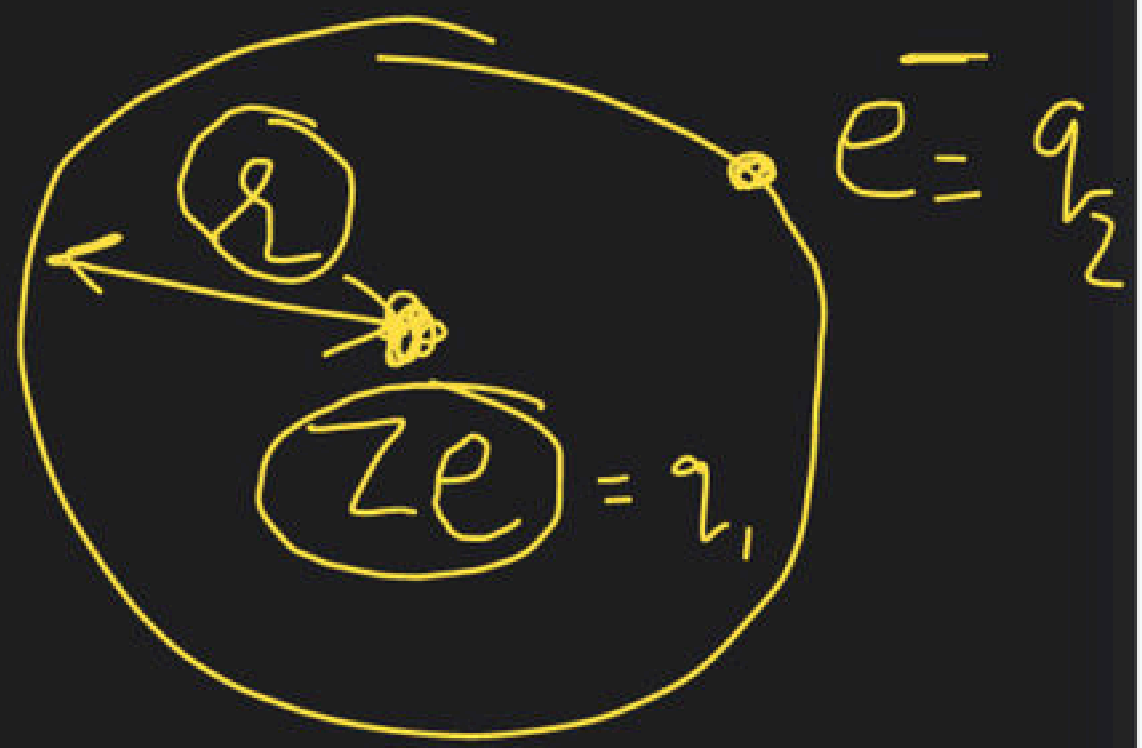
$$h\nu = E_{photon} = E_{higher} - E_{lower}$$

$$= \frac{hc}{\lambda}$$



1 Jump — 1 Photon policy

Derivation of r, v & total energy of e^- in a single electron atom:



$$mvr = n\frac{h}{2\pi} \quad \text{— (1)}$$

$$\frac{mv^2}{r} = \frac{Kq_1q_2}{r^2} = \frac{KZe^2}{r^2} \quad \text{— (2)}$$

$$\frac{m}{r}\left(\frac{nh}{2\pi m \cancel{r}}\right)^2 = \frac{KZe^2}{\cancel{r^2}}$$

$$r = \frac{n^2h^2}{4\pi^2 KZe^2 m}$$

$$\boxed{r = 0.529\,\frac{n^2}{Z}}\ \text{A}^\circ$$

$K = 9 \times 10^{9}$

$h = 6.62 \times 10^{-34}$

$m = 9.1 \times 10^{-31}\ kg$

$e = 1.6 \times 10^{-19}$

for H atom radius of 1st orbit

$r = 0.529 \text{Å} = a_0$

$= \text{Bohr radius}$

$\cancel{m} v \left(\frac{n^2 h^2}{4\pi^2 k Z e^2 \cancel{m}} \right) = \frac{nh}{2\pi}$

$v = \frac{2\pi k Z e^2}{nh} = 2.188 \times 10^6 \, Z/n$

m/sec

NCERT

$(T_c)_A < T$ $\quad$ $(T_B)_C$

17

$T_c = \frac{8a}{27Rb}$

5

H_2O

O_2

16

A

if $T < T_c$

$$b - \frac{a}{RT} = 0$$

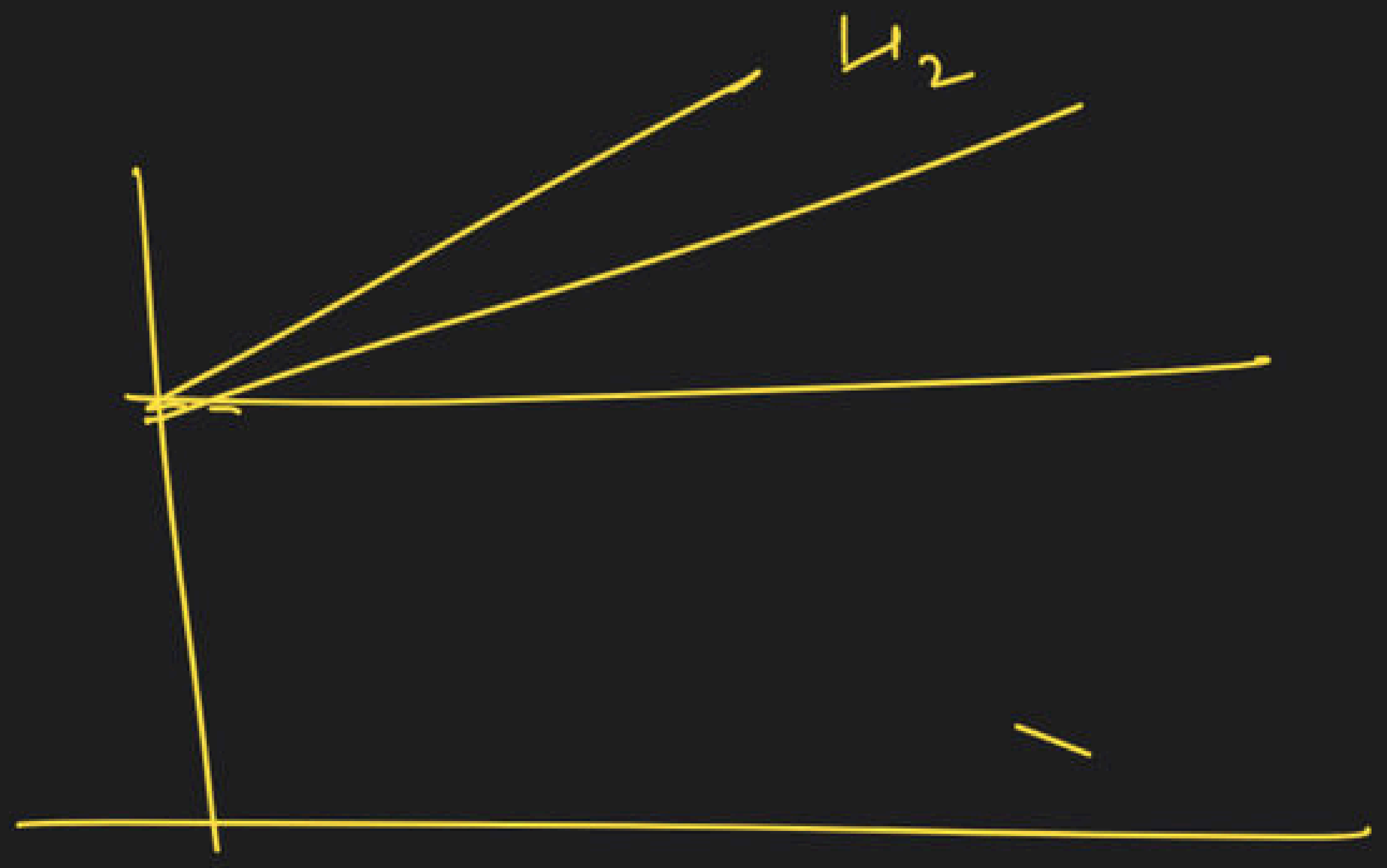
25

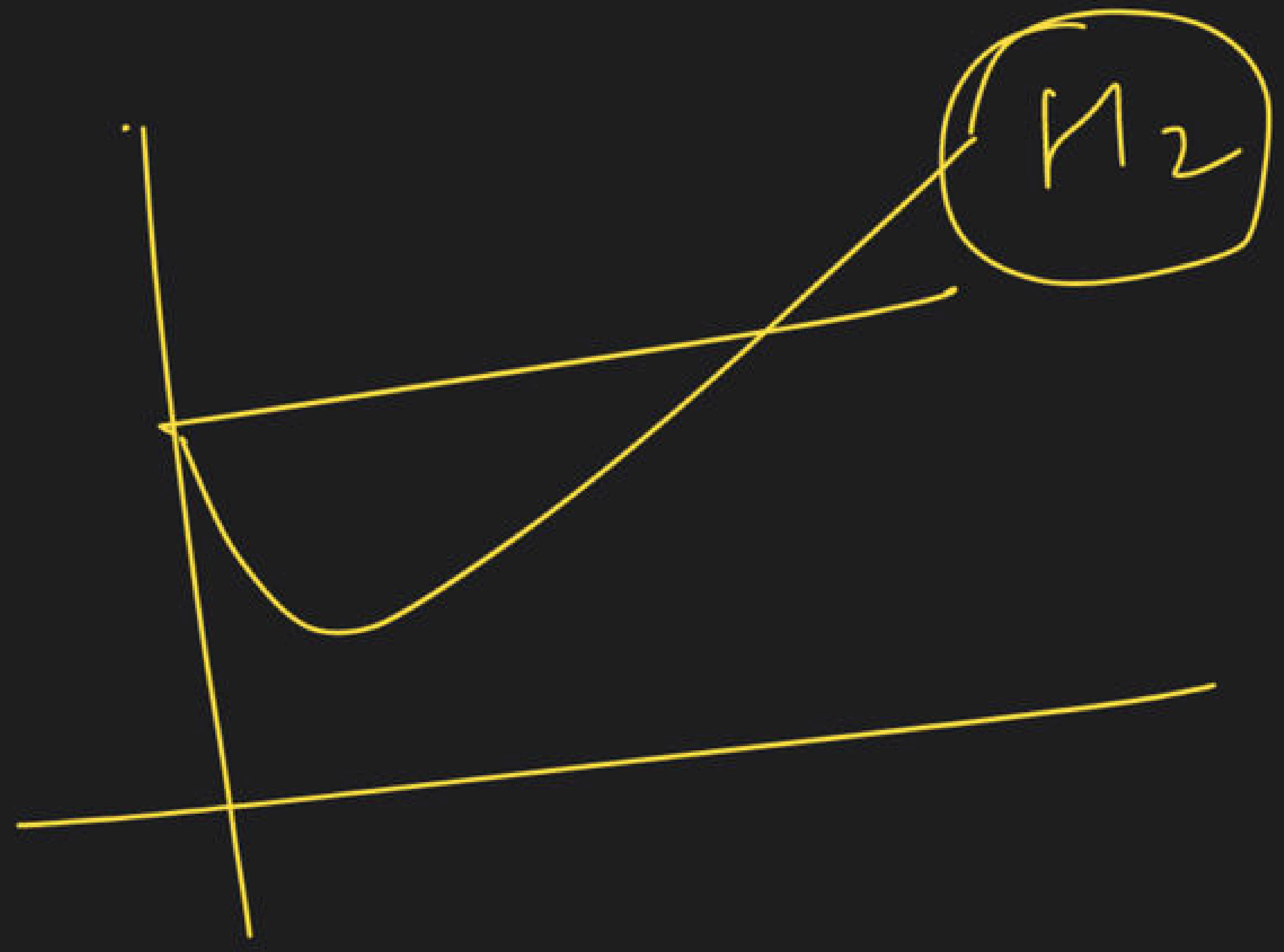
A) T

B) T

c)

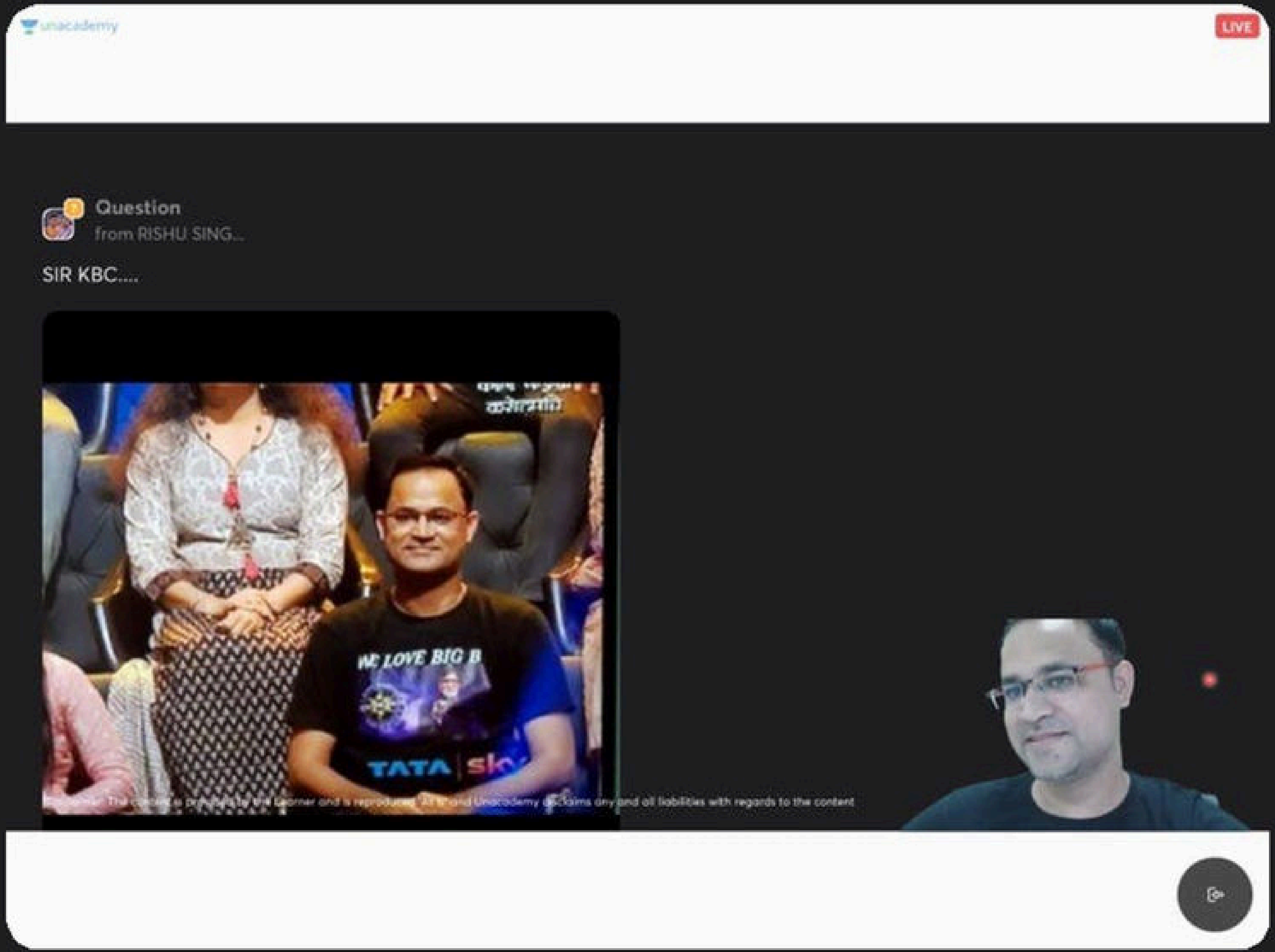
D) False





28 b False

Question
from SatyamSaur...



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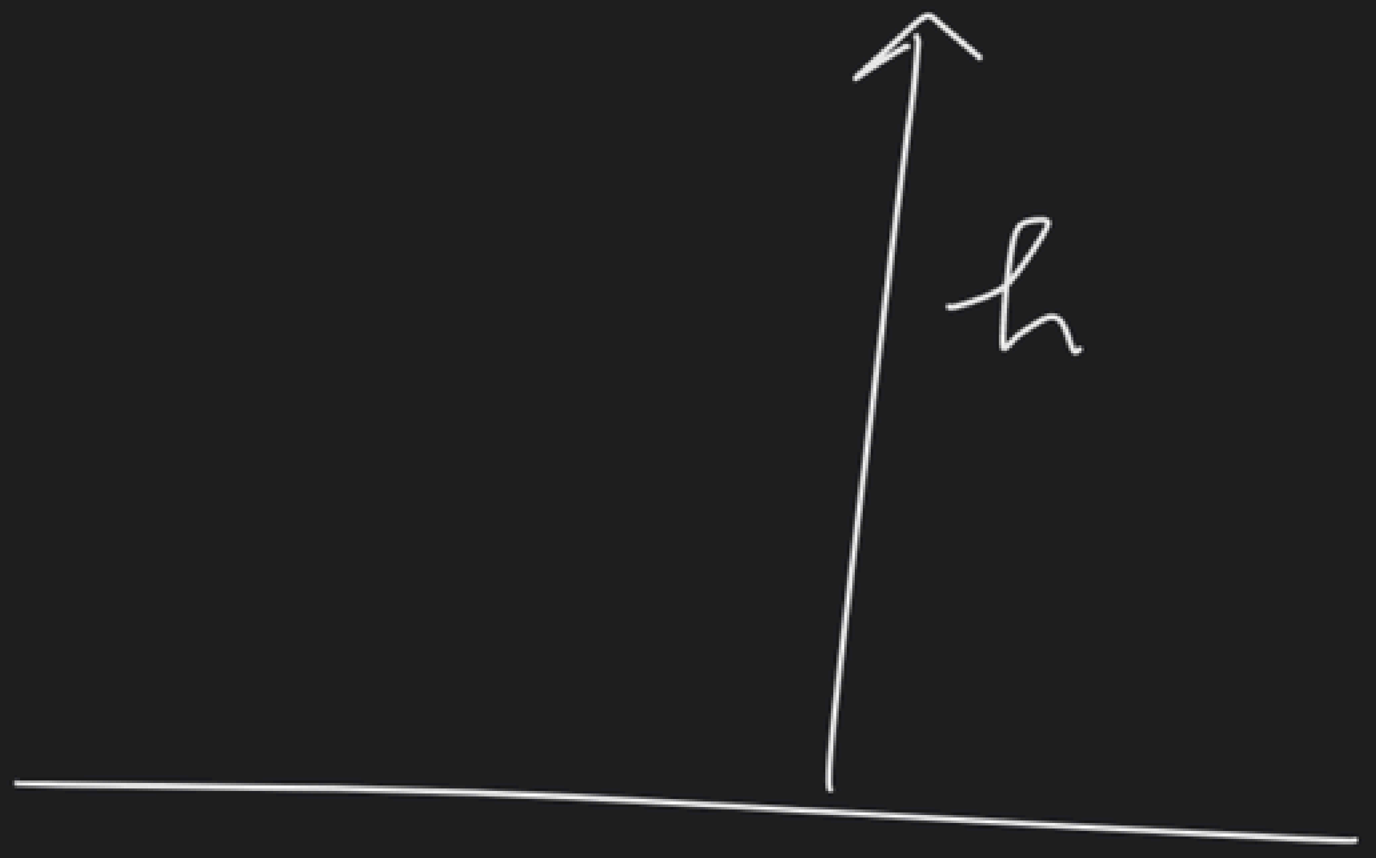
$PE = mgh$



$0 = PE$