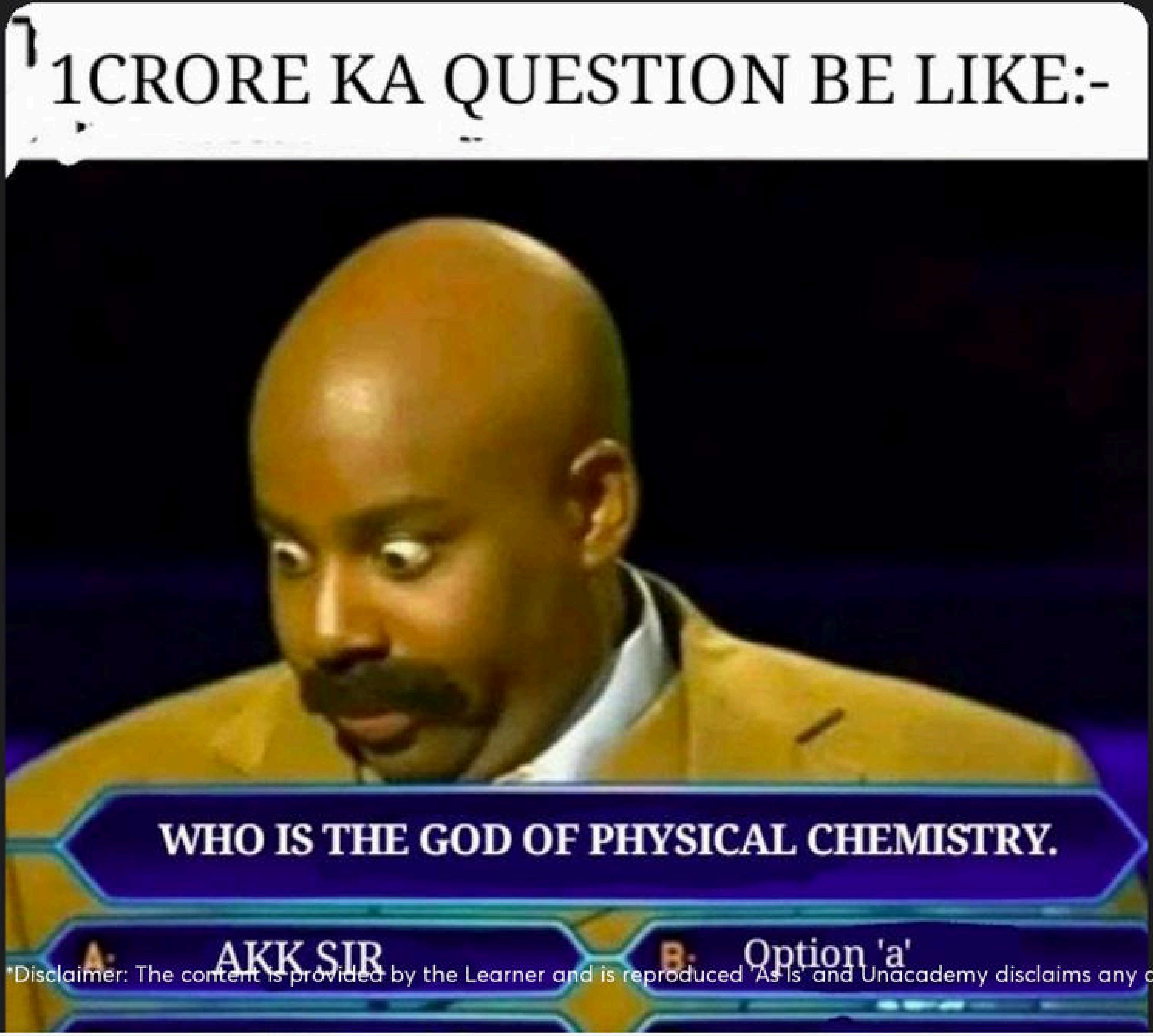
Bohr Model

Course on Atomic Structure for Class XI

akhilesh • Lesson 5 • Aug 30, 2021

Question
from SAYAK



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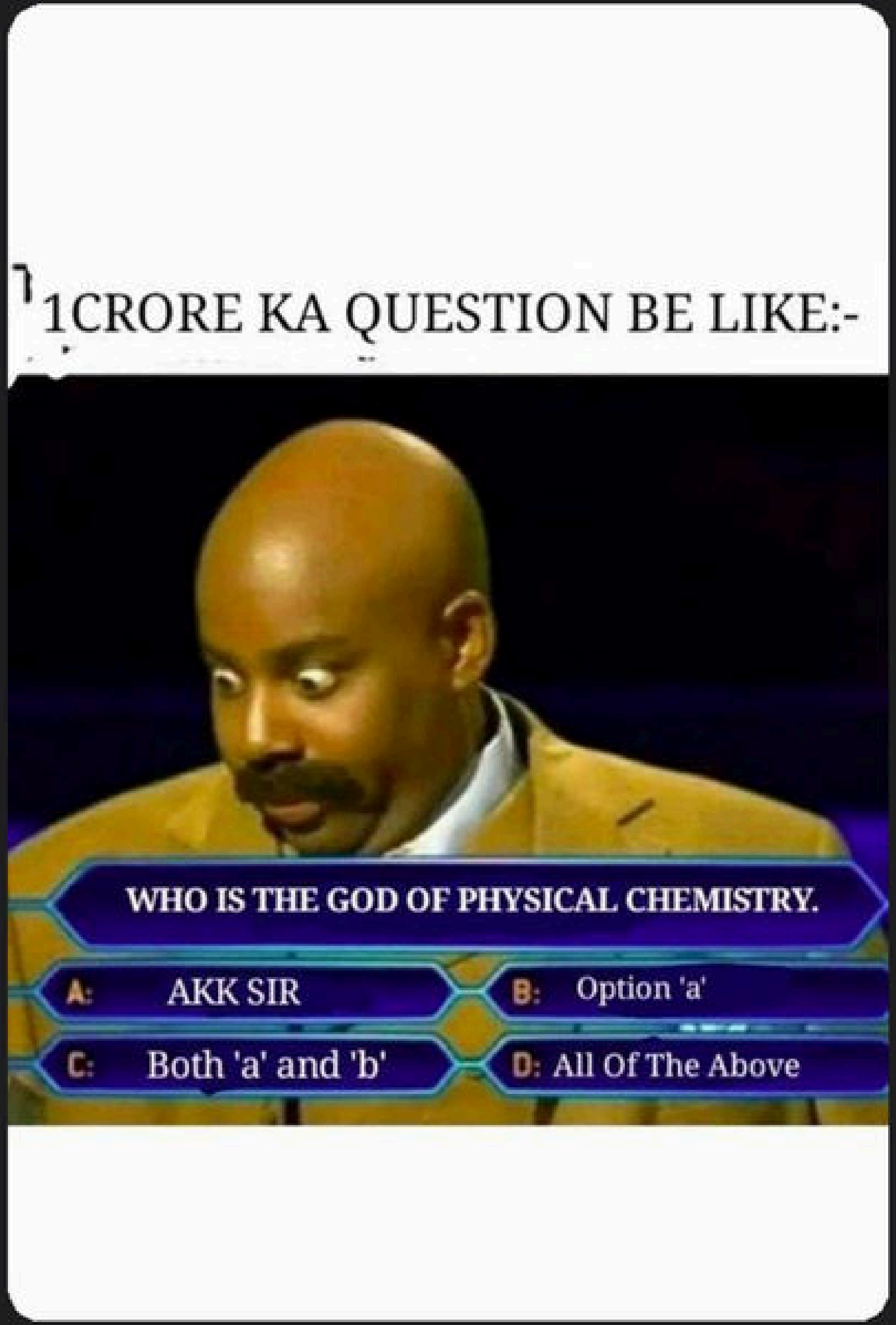
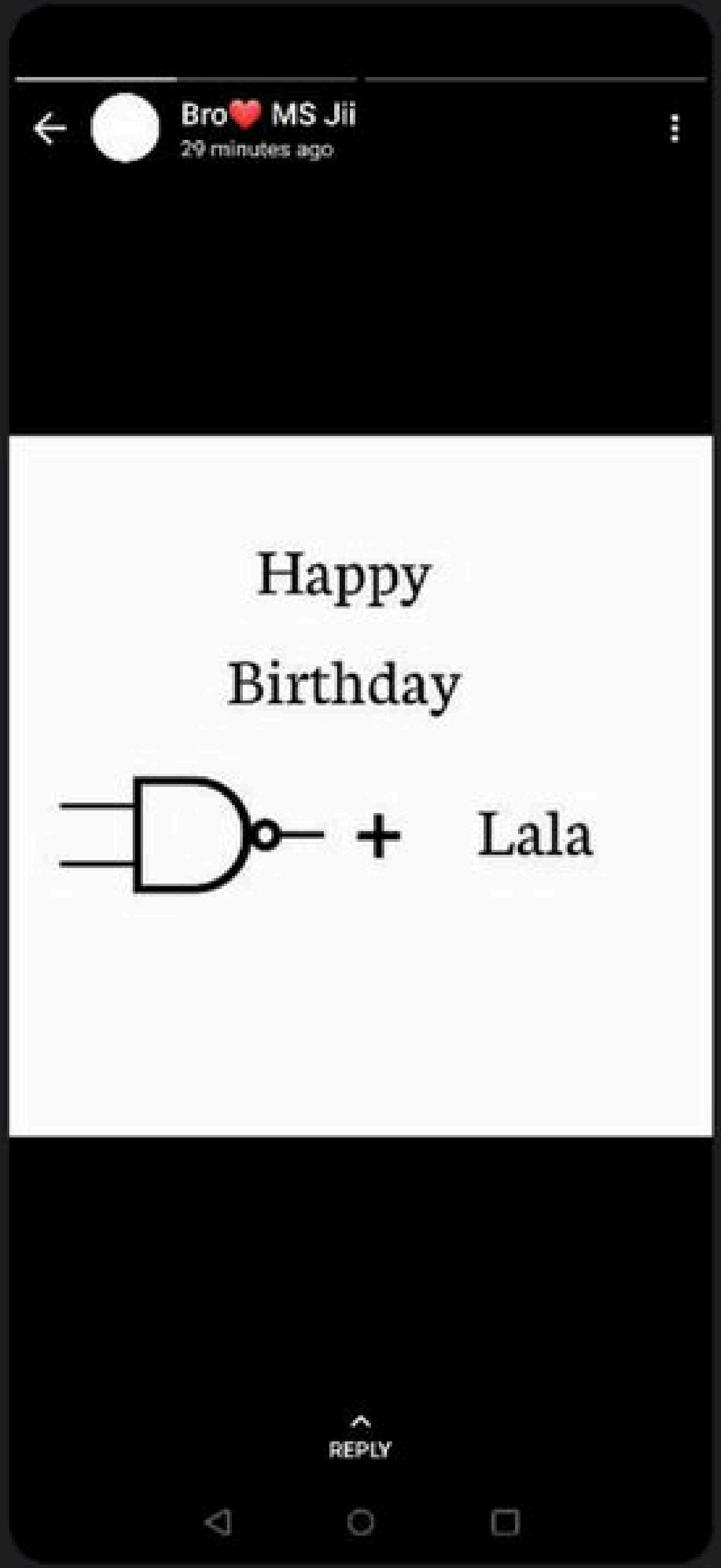


Question

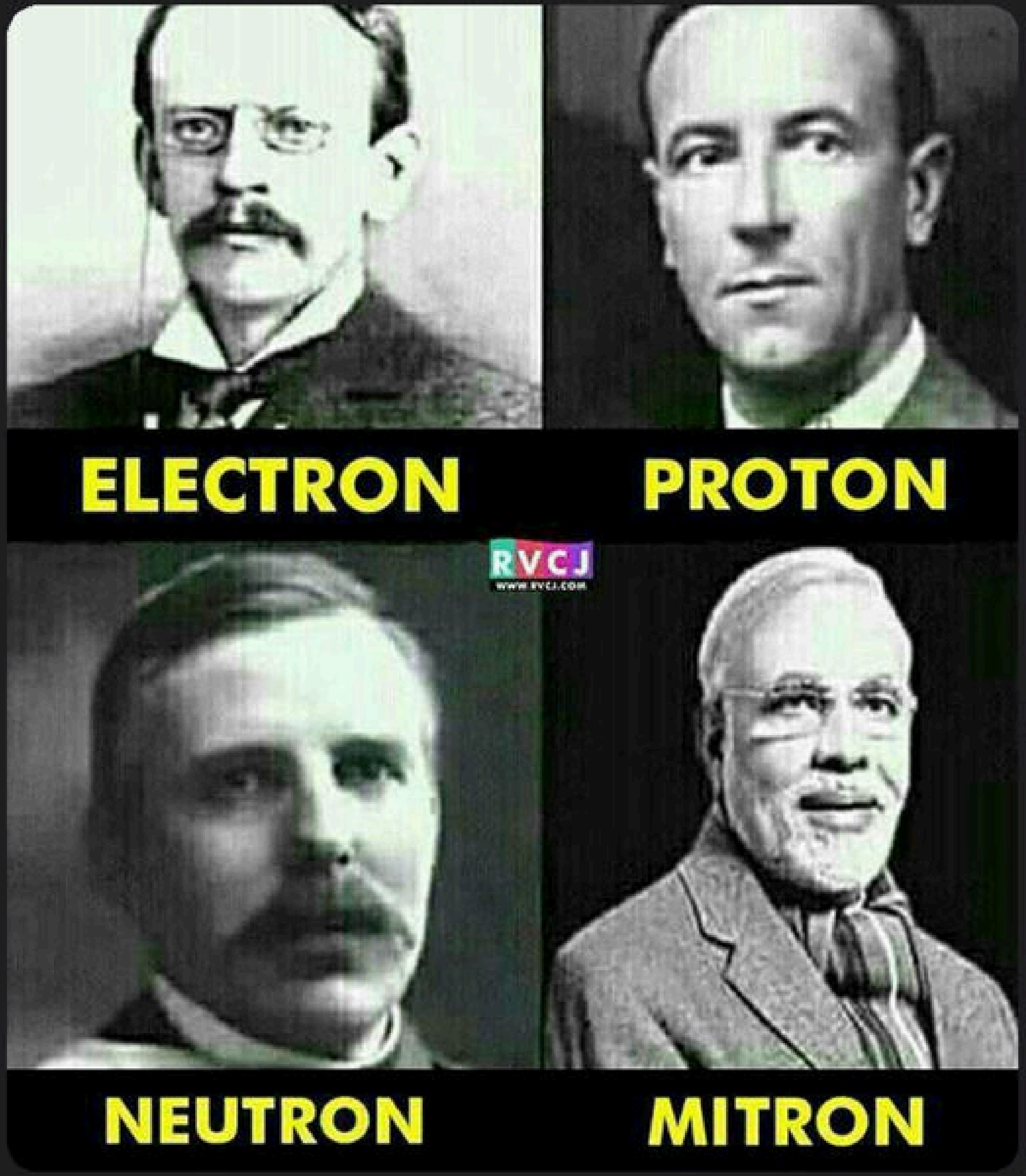
from NikitaSing...

Happy janmashtmi sir



Question

from NikitaSing...



Question

from Prasidh

Sir, Doubt from NCERT...Sir, I have understood the Surface Energy but unable to understand this paragraph on Surface Tension.

Prasidh Bhardwaj

Its dimensions are J m^{-2}. Surface tension is defined as the force acting per unit length perpendicular to the line drawn on the surface of liquid. It is denoted by Greek letter γ (Gamma). It has dimensions of kg s^{-2} and in SI unit it is expressed as N m^{-1}. The lowest energy state of the liquid will be when surface area is minimum. Spherical shape satisfies this condition, that is why mercury drops are spherical in shape. This is the reason that sharp glass edges are heated for making them smooth. On heating, the glass melts and the surface of the liquid tends to take the rounded shape at the edges, which makes the edges smooth. This is called fire polishing of glass.

Energy

$$T.E = K.E + PE$$

$$T.E = \frac{1}{2}mv^2 - \frac{K(Ze)(e)}{r} \quad \text{—— } 3$$

$$\frac{mv^2}{\cancel{r}} = \frac{KZe^2}{r^{\cancel{2}}} \quad \text{—— } 2$$

$$T.E. = \underbrace{\frac{1}{2}\frac{KZe^2}{r}}_{} - \frac{KZe^2}{r}$$

$$TE = -\frac{1}{2}\frac{KZe^2}{r}$$

$$T.E = -\frac{1}{2}\frac{KZe^2}{r}$$

$$= -\frac{2\pi^2 K^2 Z^2 e^4 m}{n^2 h^2}$$

$$\boxed{T.E. = -13.6\,\frac{Z^2}{n^2}\,eV} + 100$$

$r_{n,2}$

$r_{1,2}$

(1) $\dfrac{r_{1,1}}{r_{2,2}} = \dfrac{1}{2}$

(3) $\dfrac{v_{2,1}}{v_{1,2}} = \dfrac{1/2}{2/1} = \dfrac{1}{4}$

(2) $\dfrac{r_{1,2}}{r_{2,1}} = \dfrac{1}{8}$

(4) $\dfrac{v_{1,1}}{v_{3,3}} = 1$

⑤ $\dfrac{T.E_{2,2}}{T.E_{1,1}} = 1$

$\dfrac{1/9}{1/4}$

⑧ $\dfrac{KE_{3,1}}{KE_{2,1}} = 4/9$

⑥ $\dfrac{T.E_{2,1}}{T.E_{1,1}} = \dfrac{1}{4}$

⑨ $\dfrac{PE_{1,2}}{PE_{2,1}} = 16$

⑦ $\dfrac{T.E_{3,1}}{T.E_{2,1}} = \dfrac{4}{9}$

$\dfrac{Z^2}{n^2}$

Q. If mass of e^- is doubled, what will be the radius and Speed of e^- in 1st orbit of H-atom.

radius

$$r = \frac{n^2h^2}{4\pi^2 K Z e^2 m}$$

A) $0.529\ A^\circ$

B) $0.529/4\ A^\circ$

C) $0.529/2\ A^\circ$ ✓

D) $0.529 \times 2\ A^\circ$

A) 2.188×10^5

B) $(\quad '' \quad)/4$

C) $(\quad '' \quad)/2$

D $(\quad '' \quad) \times 2$

$$v = \frac{2\pi k Z e^2}{nh}$$

If charge on e^- & proton are doubled find T.E. of e^- in 1st orbit of H-atom

A) -13.6 eV

B) -13.6×4 eV

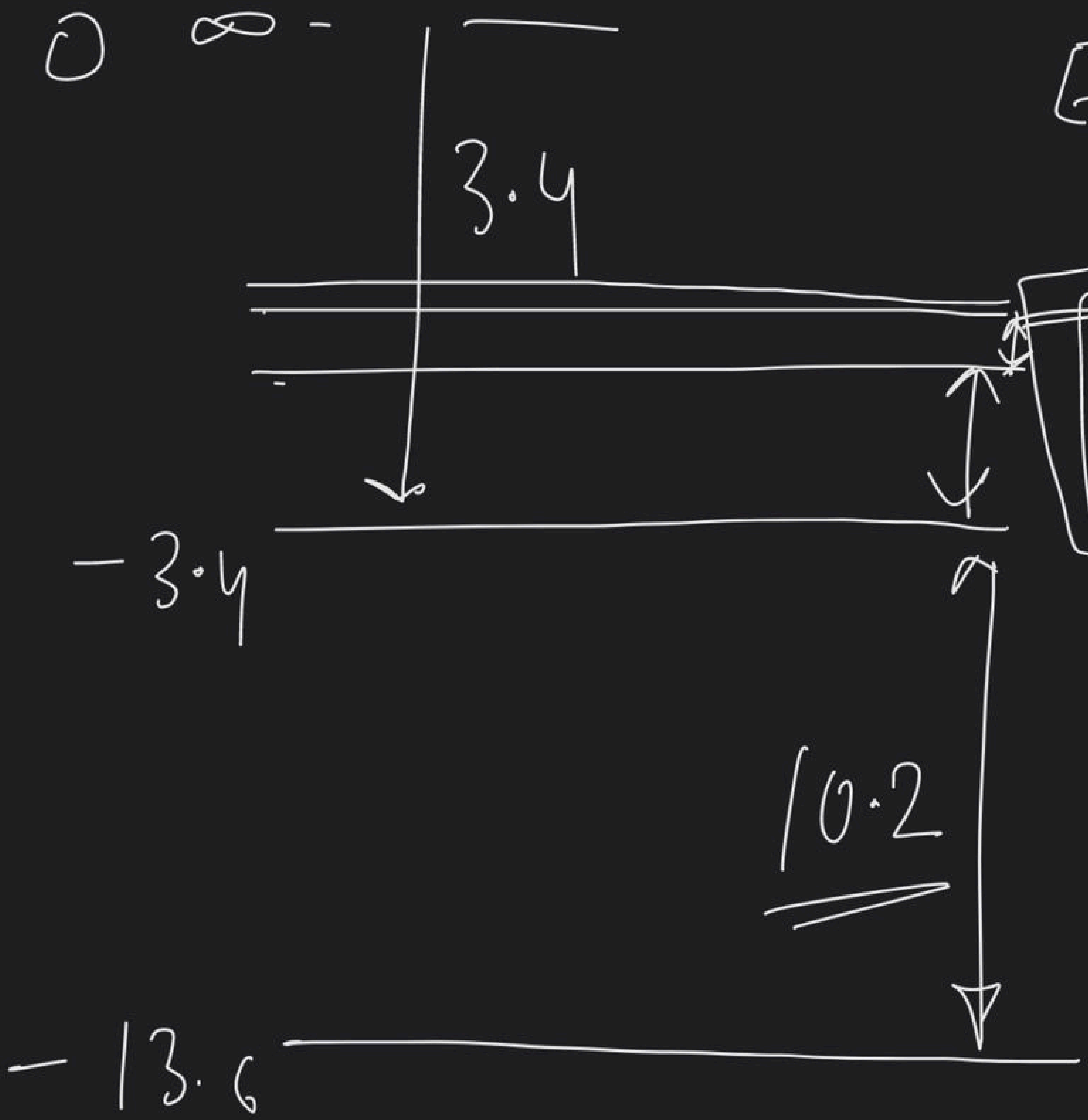
C) -13.6×16 eV

D) $-13.6/4$ eV

E) None

	T.E $(Z=1)$		T.E $(Z=2)$
$n=1$	-13.6		-54.4
		10.2	
$n=2$	-3.4		-13.6
		1.89	
$n=3$	-1.51		-6.04
$n=4$	-0.85		-3.4
$n=5$	-0.54		-2.18

$$\frac{-13.6\, Z^2}{n^2}$$



$E_{2-1} > E_{3-2} > E_{4-3}$

$$\boxed{E_{2-1} > E_{\infty-2}}$$

$T.E_{\infty} = 0$

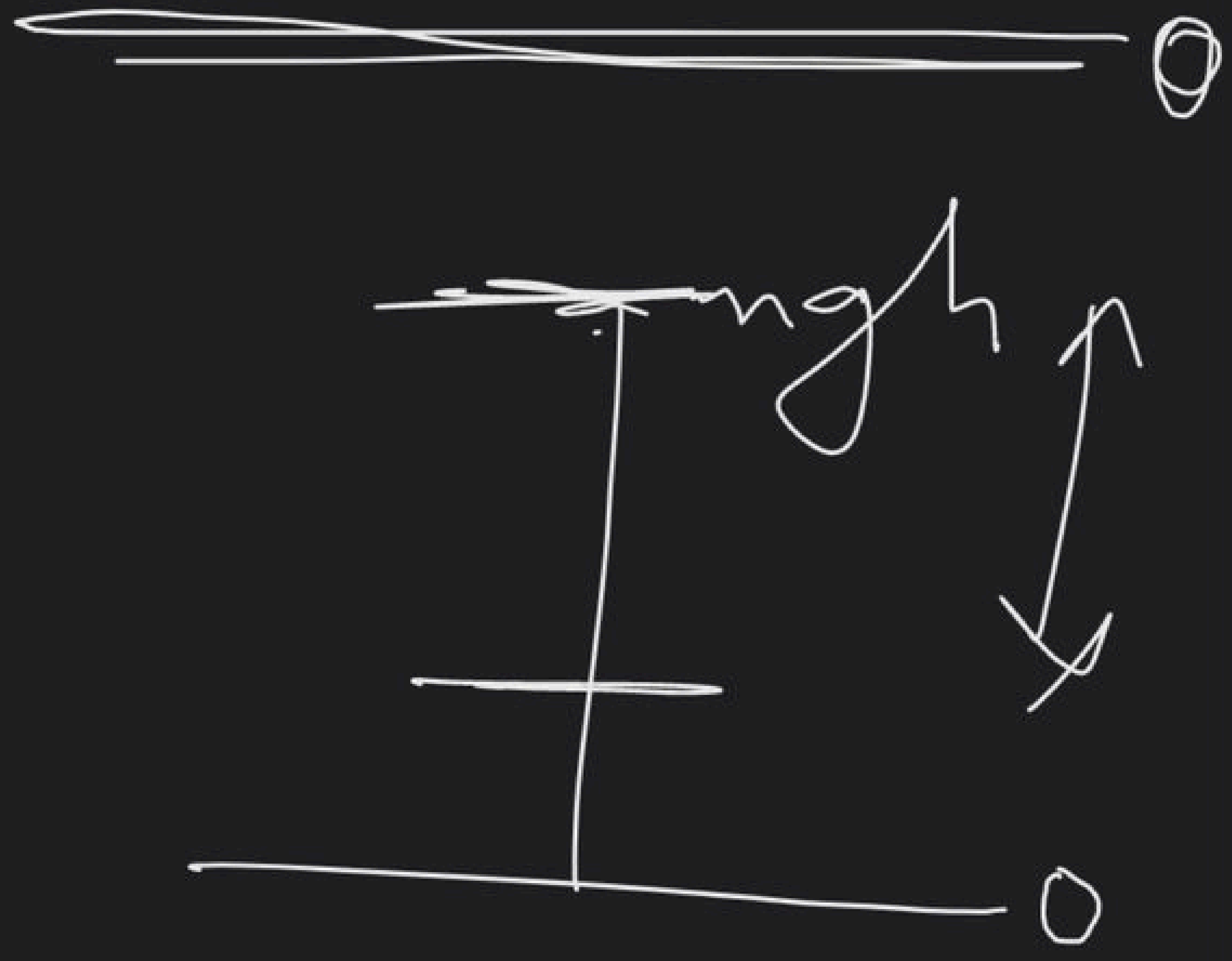
H $\qquad$ He^{+} $\qquad$ Li^{2+}

$1 - 2$ $\qquad$ $2 - 4$ $\qquad$ $3 - 6$

$$\Delta E_{2-3} = \Delta E_{4-6} = \Delta E_{6-9}$$

$KE = -TE$

$PE = 2\,T.E.$



Energy of photon emitted / absorbed :→

$$h\nu = \frac{hc}{\lambda} = E_{higher} - E_{lower}$$

$$= -\frac{13.6\,Z^2}{n_2^2} + \frac{13.6\,Z^2}{n_1^2}$$

$$\frac{Ryonmar}{\lambda} = \frac{hc}{\lambda} = 13.6\,Z^2\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] eV$$

find Energy of photon emitted

1. $2 \longrightarrow 1$ In H-atom $10.2\ eV = \frac{hc}{\lambda}$

2. $3 — 1$ In He^+ $48.36\ eV = \frac{hc}{\lambda}$

3. $3 \longrightarrow 1$ In H-atom $12.09\ eV =$

4. $\infty \longrightarrow 1$ In H-atom $13.6\ eV$

Rydberg eqn

Z

$$\bar{\nu} = \frac{1}{\lambda} = R_H Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$$

$$R_H = 109700 \text{ cm}^{-1}$$

$$\frac{1}{R_H} = 912 \text{ A}^\circ$$

Ionisation energy / Binding energy / Separation energy

-13.6

$\infty \quad TE = 0$

$$\Delta TE = TE_{\infty} - TE$$

$$\text{Ionisation Energy} = 0 + 13.6\,\frac{Z^2}{n^2}$$

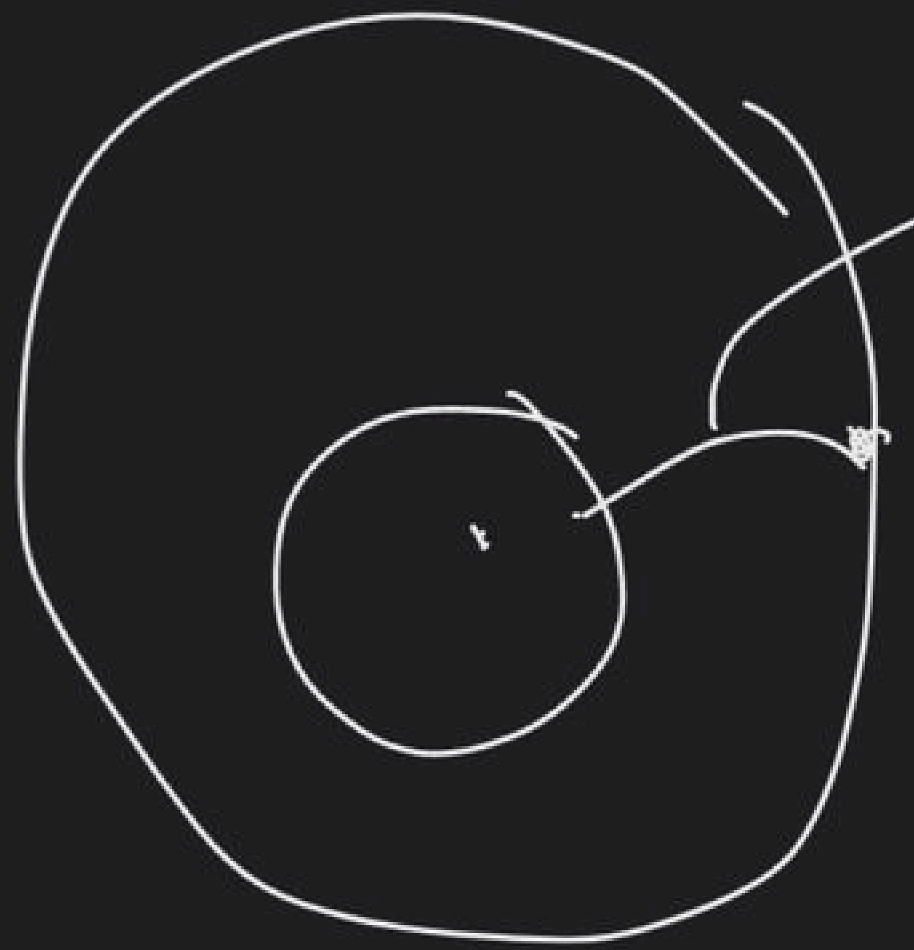
$$\text{Binding energy} = \text{Ionisation Energy}$$

$$= 13.6\,\frac{Z^2}{n^2}$$

$$T.E = \frac{-13.6\, Z^2}{n^2}$$

Energy of 1^{st} orbit $= -13.6\, Z^2$

$$TE = \frac{TE_{1^{st}\ \text{orbit}}}{n^2}$$



Excitation energy

frequency of e^- in an orbit = no. of rounds/sec

$$= \frac{v}{2\pi r}$$

$$\propto \frac{Z/n}{n^2/Z}$$

$$\propto Z^2/n^3$$

Time period $= \frac{1}{f} = \frac{2\pi r}{v}$

time required to complete one round

$$T \propto r^3/Z^2$$

[redacted]

1. According to Bohr's atomic theory :-

Shift-2 24th Feb, 2021

(A) Kinetic energy of electron is $\propto \frac{Z^2}{n^2}$

(B) The product of velocity (v) of electron and principal quantum number (n), 'vn' $\propto Z^2$

(C) Frequency of revolution of electron in an orbit is $\propto \frac{Z^3}{n^3}$

$\frac{KZe^2 Z^2}{\cancel{r^2}\, n^4}$

(D) Coulombic force of attraction on the electron is $\propto \frac{Z^3}{n^4}$

Choose the most appropriate answer from the options given below :

(1) (C) Only

(2) (A) Only

(3) (A), (C) and (D) only ×

(4) (A) and (D) only

15 — 26 5 - 1

5 — 20 0 - 1