* Success of Bohr's atomic Model :-

(1) Radius of an atom (Calculation of radius)

Radius may be calculated by following eqⁿ -

$$r_n = \frac{n^2 h^2}{4\pi^2 me^2 Z} \quad \text{---- (1)}$$

where, n = no. of orbit

h = plank's constant = 6.626×10^{-34} J sec.

$\pi = 22/7 = 3.414$

m = mass of an electron = 9.1×10^{-31} kg

e = charge of an electron = 1.602×10^{-19} C

Z = atomic no.

on putting all these values in eqⁿ — (1), we get.

$$\boxed{r_n = 0.529\ \text{Å} \times \frac{n^2}{Z}}$$

for H-atom. — $n=1$, $Z=1$

$$r_H = 0.529\ \text{Å}.$$

called Bohr's radius for H-atom.

for H like species. —

He^+ ion,	Li^{++} ion,
$n = 1, 2, 3 \ldots$	$n = 1, 2, 3 \ldots$
$Z = 2$	$Z = 3$.

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(2). Calculation of Energy :-

The energy of the electron may be calculated from the following formula —

$$E_n = -\frac{2\pi^2 m e^4 Z^2}{n^2 h^2} \quad \text{——— (1)}$$

Where, m = mass of an electron $= 9.1 \times 10^{-31}$ kg

$\pi = 22/7 = 3.414$

e = charge of an electron $= 1.602 \times 10^{-19}$ C

Z = atomic no.

n = orbit no. $= 1, 2, 3 \ldots$

h = planck's constant $= 6.626 \times 10^{-34}$ Joule

Putting all these values in eq^n — (1) we get -

$$\boxed{E_n = -13.6 \times \frac{Z^2}{n^2} \text{ ev/atom.}} \quad \text{——— (2)}$$

Since, $1 \text{ ev} = 1.602 \times 10^{-19}$ J

$$E_n = -13.6 \times \frac{Z^2}{n^2} \times 1.602 \times 10^{-19} \text{ J/atom.}$$

$$E_n = -21.78 \times \frac{Z^2}{n^2} \times 10^{-19} \text{ J/atom}$$

$$\boxed{E_n = -2.18 \times 10^{-18} \text{ J/atom} \times \frac{Z^2}{n^2}} \quad \text{——— (3)}$$

or $E_n = -2.18 \times 10^{-18} \times 6.022 \times 10^{23} \text{ J/mole} \times \frac{Z^2}{n^2}$

$$E_n = -13.12 \times 10^5 \text{ J/mole} \times \frac{Z^2}{n^2}$$

or $\boxed{E_n = -1312 \text{ KJ/mole} \times \frac{Z^2}{n^2}}$ — (4)

For H-atom

$n=1,\ Z=1.$

$E_H = -13.6 \text{ ev/atom.}$

For H-like specises-

He^+	Li^{++}
$n = 1,2,3.\ldots$	$n = 1,2,3\ldots$
$Z = 2$	$Z = 3$.

(3) Calculation of Velocity of an electron :-

Velocity of an electron is calculated by the formula —

$$V_n = \frac{2\pi e^2 Z}{nh} \text{ m sec}^{-1} \quad \text{— (1)}$$

Where, $\pi = 22/7 = 3.414$

e = charge of an electron $= 1.602 \times 10^{-19}$ C

Z = atomic no.

n = orbit no.

h = planck's constant $= 6.626 \times 10^{-34}$ J sec.

putting all these values in eq^n — (1), we get-

$$V_n = 2.19 \times 10^6 \times \frac{Z}{n} \text{ m sec}^{-1}.$$

$$V_n = 2.19 \times 10^8 \times \frac{Z}{n} \text{ cm sec}^{-1}.$$

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