STRUCTURE ATOMS NUCLEI

$$1\,eV = 1.6\times10^{-19}\,J$$

$$N = \frac{kZ^2}{\sin^4\frac{\theta}{2}}$$

$k \to$ constant
$Z \to$ Atomic No. of foil
$N \to$ No. of α-p deviated at θ

Distance of closest approach:

$$r_0 = \frac{2Ze^2}{4\pi\varepsilon_0 K.E}$$

$Z \to$ at. no. of atom

Impact Parameter

$$b = \frac{kZe^2}{K.E}\sqrt{\frac{1+\cos\theta}{1-\cos\theta}}$$

$k \to$ constant $\Rightarrow$ 1.77 MeV
$K.E \to$ initial K.E of α in
$Z \to$ at no. of foil
$\theta \to$ scattering $\angle$
$b \to$ in fermi

$$1\text{ fermi} = 10^{-15}\,m$$

r, V, P.E, K.E, T.E

$$r_n = \frac{n^2h^2\varepsilon_0}{\pi m_e Ze^2}$$

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

for H-atom
$Z = 1,\ n = 1$

$$r = 0.529\,A^\circ = a_0$$

$$a_0 = \frac{h^2\varepsilon_0}{\pi m_e e^2} \Rightarrow \text{Bohr's Radius}$$

$$a_0 = 0.053\,nm$$

$$V = \frac{Ze^2}{2\varepsilon_0 hn}$$

$$V = 2.18\times10^6 \times \frac{Z}{n}\,m/s$$

$$K.E = \frac{m_e Z^2e^4}{8\varepsilon_0^2h^2n^2}$$

$$P.E = -\frac{2m_e Z^2e^4}{8\varepsilon_0^2h^2n^2}$$

$$T.E = -\frac{m_e Z^2e^4}{8\varepsilon_0^2h^2n^2}$$

$$P.E = -2K.E = 2T.E$$

$$K.E = B.E = -T.E = -\frac{P.E}{2}$$

*K.E cannot Be negative

V.V. Imp

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

$$T.E = -2.18\times10^{-18}\frac{Z^2}{n^2}\,J$$

$$\lambda = \frac{12375}{E_{photon}(eV)}\,A^\circ$$

$$\frac{1}{\lambda} = Z^2R_H\left(\frac{1}{n^2}-\frac{1}{m^2}\right)$$

$$\frac{1}{R} \approx 911\,A^\circ$$ *

$$R_H = 1.09\times10^7\,m^{-1}$$

longest λ $\to$ smallest transition

smallest λ $\to$ largest transition

Law of Radioactive Decay

$$N = N_0e^{-\lambda t}$$

N: No. of nuclei left undecayed at time t
N_0: initial number of nuclei ($t=0$)

$$t_{1/2} = \frac{0.693}{\lambda} = \frac{\log_e 2}{\lambda}$$

Activity of a Radioactive

$$A = A_0e^{-\lambda t}$$

$$A_0 = \lambda N_0$$

$$\tau = \frac{1}{\lambda}$$

Avg life > Half life

$$\tau_{avg} = 1.443\,t_{1/2}$$

$$t_{1/2} = \tau\log_e 2 = 0.693\tau$$

unit of Activity / Radio activity

1) Becquerel = 1 Bq = 1 decay/sec
2) Curie (Ci) = 1 Ci = 3.7×10^{10} decay/sec
$1\,Ci = 3.7\times10^{10}\,Bq$
3) 1 rutherford = 10^6 decay/sec $= 10^6\,Bq$

Period of revolution $\boxed{T \propto n^3}$

$r \propto n^2$
$v \propto \frac{1}{n}$
$E \propto \frac{1}{n^2}$

Momentum of photon $\boxed{P = \frac{h\nu}{c}}$

acceleration of e^- ($n=1$) $\quad a = \frac{v^2}{r} = \frac{h^2}{4\pi^2m^2r^3}$

if e^- is in n^{th} orbit, unique spectral line will be

$$\boxed{\frac{n(n-1)}{2}}$$

Energy levels in Hydrogen

$n=1$	K-shell	$E1 = -13.6\,eV$ (ground state)
$n=2$	L-shell	$E2 = -3.4\,eV$ (first Excited state)
$n=3$	M-shell	$E3 = -1.5\,eV$ (2^{nd} ")
$n=4$	N-shell	$E4 = -0.85\,eV$ (3^{rd} ")
$n=5$	O-shell	$E5 = -0.54\,eV$ (4^{th} ")
$n=6$		$E_6 = -0.37\,eV$ (5^{th} ")
		$E_7 = -0.27\,eV$ (6^{th} ")
$n=\infty$	...	$E_\infty = 0\,eV$

Ionization Energy

$$E_{ionisation} = E_\infty - E_n = 0 - \left(-13.6\frac{Z^2}{n^2}\right)$$

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

1^{st} excited state $\to n=2$
2^{nd} excited state $\to n=3$

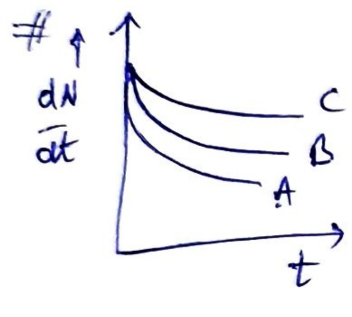
No. of unique wavelengths $= \frac{(n_2-n_1)(n_2-n_1+1)}{2}$

r & V for first orbit in hydrogen atom of e^- $\underline{r = 0.5 \mathring{A}}$ $\underline{V = 2.18 \times 10^6 m/s}$

Rydberg const. $R = \dfrac{me^4}{8 \varepsilon_0^2 h^3 c}$

According to Rutherford's model of an atom: all the positive charges of an atom is concentrated in a small region at the centre of an atom.

In LC circuit :- Energy stored in $L \rightarrow$ magnetic But in $C \rightarrow$ electrical



$A \rightarrow$ shorter mean life

- sphere of gold when Brought towards a powerful magnet experiences <u>repulsive force</u>.