Formulas:

① Estimation of closest distance of approach of α-particle

$$R = \frac{4KZe^2}{m_\alpha v_\alpha^2}$$

② Radius of nucleus: $R = R_0(A)^{1/3}$ cm

③ Planck's Quantum Theory

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

④ Photo electric effect

$h\nu = h\nu_0 + \frac{1}{2}m_e v^2$

⑤ Bohr's model for hydrogen like atoms:

- $mvr = n\frac{h}{2\pi}$, $E_n = -\frac{E_1}{n^2}Z^2 = 2.178\times10^{-18}\frac{Z^2}{n^2}$ J/atom $= 13.6\frac{Z^2}{n^2}$ e.V; $E_1 = \frac{-2\pi m e^4}{n^2}$
- $r_n = \frac{n^2}{Z} \times \frac{n^2}{4\pi^2 e^2 m} = \frac{0.529\times n^2}{Z}$ A
- $V = \frac{2\pi Z e^2}{nh} = \frac{2.18\times10^6 \times Z}{n}$ m/s.

⑥ De-Broglie wavelength:

$\lambda = \frac{h}{mc} = \frac{h}{p}$ (for photon)

⑦ wavelength of emitted photon:

$\frac{1}{\lambda} = \bar{\nu} = RZ^2\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

⑧ Number of photons emitted by a sample of H atom:

$$\frac{\Delta n(\Delta n+1)}{2}$$

⑨ Heisenberg's uncertainity principle

$\Delta x \cdot \Delta p > \frac{h}{4\pi}$ (or) $m\Delta x \cdot \Delta v \geq \frac{h}{4\pi}$ (or) $\Delta x \cdot \Delta v \geq \frac{h}{4\pi m}$.

⑩ Quantum Numbers:

- principal Quantum number $(n) = 1, 2, 3, 4 \ldots$ to ∞
- Orbital angular momentum of electron in any orbit $= \frac{nh}{2\pi}$.
- Azimuthal quantum number $(l) = 0, 1, \ldots$ to $(n-1)$
- Number of orbitals in a subshell $= 2L+1$
- Maximum number of electrons in particular subshell $2\times(2L+1)$
- Orbital angular momentum $L = \frac{h}{2\pi}\sqrt{l(l+1)} = \hbar\sqrt{l(l+1)}$, $\left(\hbar = \frac{h}{2\pi}\right)$