Physics Basic Formula's for IIT & JEE

Work Function

The minimal amount of energy needed to remove one electron from the surface of a particular solid to infinity is the work function, which is a property of a material.

$W = hv_0 = \frac{hc}{\lambda}$

Intensity in terms of electric field

A unit charge placed at a given area would experience that point's electric field intensity as a force. The intensity of the electric field is a vector quantity in nature.

$I = \frac{1}{2}\epsilon_0 E^2 . c$

Momentum of one proton

$Momentum = \frac{h}{\lambda}$

Energy

$\Delta E = \frac{12400}{\lambda(A^0)} eV$

De Broglie Wavelength

The de Broglie wavelength is a crucial topic to understand while studying quantum mechanics. De Broglie wavelength is a term used to describe the wavelength (λ) that is connected to an item in relation to its momentum and mass.

$\lambda = \frac{h}{mv} = \frac{h}{p} = \frac{1}{\sqrt{2mKE}}$

Radius and speed of electron in hydrogen like atoms

$r_n = \frac{n^2}{Z} a_0 \ \ Where \ \ a_0 = 0.529\dot{A}$

$V_n = \frac{Z}{n} V_o \ where \ V_0 = 2.19 \times 10^8 \frac{m}{s}$

Energy in nth orbit

$E_n = E_1 . \frac{Z^2}{n^2} \ \ Where \ E_1 = -13.6 \ eV$

Wavelength corresponding to spectral lines

$\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

For Lyman series $n_1 = 1 \ and \ n_2 = 2,3,4,..$

For Balmer Series $n_1 = 2 \ and \ n_2 = 3,4,5. \ldots$

For Paschen series $n_1 = 3 \ and \ n_2 = 4,5,6 \ldots.$

Total number of possible transition for nth state

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

Minimum wavelength for X-rays

$$\lambda = \frac{hc}{eV_0} = \frac{12400}{V_0(Volt)}\dot{A}$$

Moseley's Law

$$\sqrt{V} = a(z-b)$$

Average radius of nucleus is written as

$$R = R_0 A^{\frac{1}{3}} \; where \; R_0 = 1.1 \times 10^{-15} M$$

A is the mass

Activity of a sample

$$A = A_0 e^{-\lambda t}$$

Half life

$$T_{\frac{1}{2}} = \frac{0.693}{\lambda}$$

Average Life

$$T_{avg} = \frac{T_{\frac{1}{2}}}{0.693}$$

A radioactive nucleus can decay by two different processes having half lives t_1 and t_2 respectively. Effective half-life of nucleus is given by

$$\frac{1}{t} = \frac{1}{t_1} + \frac{1}{t_2}$$

If effect of nucleus motion is considered

$$r_n = \left(0.529\dot{A}\right)\frac{n_2}{Z}.\frac{m}{\mu}$$

$$E_n = (-13.6eV)\frac{Z^2}{n_2}.\frac{\mu}{m}$$

Here μ is reduced mass

$\mu = \frac{Mm}{(M+m)}, Where\ M\ is$ Mass of nucleus