Or, $(a+b)sin\theta = n\lambda$

For n^{th} order maxima: $(\boldsymbol{a}+\boldsymbol{b})\boldsymbol{sin\theta_n} = \boldsymbol{n\lambda}$ **This is Grating Equation.**

Diffraction grating:

$N = number\ of\ lines\ per\ unit\ length$

Grating element: $(\boldsymbol{a}+\boldsymbol{b}) = \frac{\boldsymbol{1}}{\boldsymbol{N}}$

Working formula for diffraction grating: $(\boldsymbol{a}+\boldsymbol{b})\boldsymbol{sin\theta} = \boldsymbol{n\lambda}$

- For highest number of diffraction maxima:

  Put $\theta = 90^o$ i.e., $sin\theta = 1$

  Then find: $\boldsymbol{n_{max}} = \frac{(\boldsymbol{a+b})}{\boldsymbol{\lambda}}$ $[\because \boldsymbol{\theta_{max}} = \boldsymbol{90^o}]$

Recall your memory!! $1\ inch = 2.54\ cm$

$n = 0$, for central maximum

$n = 1$, for first order maxima

$n = 2$, for second order maxima.

and so on.

1. A plane transmission grating having 500 lines per mm is illuminated normally by light source of 600 nm wavelength. How many diffraction maxima will be observed on a screen behind the grating? $[Ans: 3]$
2. A parallel beam of sodium light of wavelength $5893\ A^o$ is incident normally on a diffraction grating. The angle between two first order spectra on either side of the normal is 28^0. Find the number of ruling lines per mm on the grating. $[Ans: 406\ lines/mm]$
3. Parallel beam of light from a source is incident normally on plane diffraction grating. If the angle of diffraction for first order is 30^o, find the grating element and number of lines per mm of the grating, considering wavelength of incident beam is $5893A^o$.
   $[Ans: 1.1786 \times 10^{-6} m, 848\ lines/mm]$

Resolving Power

Definition:

The resolving power of an optical instrument is defined as its ability to separate (distinguish) the images of two nearby point objects so that they can be distinctly seen.

Mathematically,

$$Resolvimg\ power = \frac{1}{limit\ of\ resolution}$$

Resolving power do not have any unit.

 # Limit of resolution: the distance between two points in the object that are just resolved in the image.

- The normal human eye can see two objects distinctly (as separate and clearly) only if angle subtended by them at the eye is greater than $1'$ $(= (1/60)^o$.

  If the angle subtended by two distinct objects is less than $1'$, they may be seen as separate from each other by using optical instruments like: lens, telescope, microscope etc.

1. $\boldsymbol{Resolving\ Power\ of\ microscope} = \frac{\boldsymbol{2\ \mu\ sin\theta}}{\boldsymbol{\lambda}}$

Where, $\boldsymbol{\mu} = R.I. of\ medium\ between\ the\ object\ and\ objective\ lens$

$\boldsymbol{\theta} = semi - vertical\ angle$ *[see given figure]*

And, $\boldsymbol{\mu\ sin\theta}$ *is called as* ***Numerical Aperture*** *of microscope.*