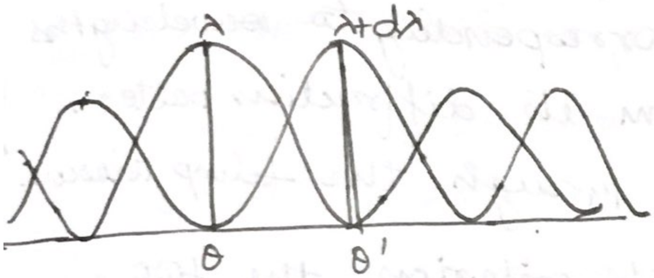
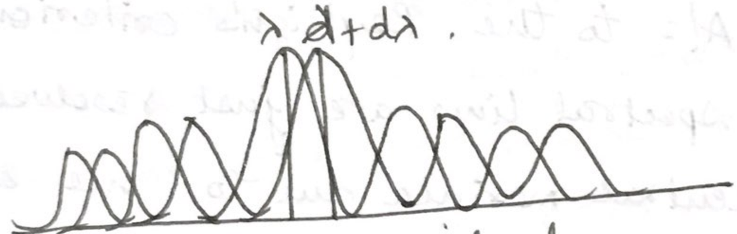
Rayleigh Criterion of RESOLUTION :

A/c to Rayleigh, "the two point sources or two equally ~~spaced~~ intense spectral lines are just resolved by an optical instrument when the central maximum of the diffraction pattern due to one source falls exactly on the first minimum of the diffraction pattern of the other and vice-versa."

Consider the intensity distribution curve of two nearby wavelengths λ and $\lambda+d\lambda$.



just Resolved.



Not resolved.

RESOLVING POWER OF DIFFRACTION GRATING:

The resolving power of a grating is defined as its ability to show the two neighbouring spectral lines separate in a spectrum.
It is defined as "the ratio of the wave-length of any spectral line to the smallest wavelength difference b/w the neighbouring lines for which the spectral lines can be just resolved at wavelength λ.
It can be expressed as $\lambda/d\lambda$.
The Rayleigh Criterion of resolution may be applied to derive the expression of resolving power of a diffraction grating.

Let a plane diffraction grating of grating element $(a+b)$ be illuminated by a light consisting of two wavelengths λ_1 and $\lambda_2 + d\lambda$.

The spectral lines corresponding to wavelengths λ_1 and $\lambda_2 + d\lambda$ will form its diffraction pattern which can be seen through the ~~telesp~~ telescope.

A/c to the Rayleigh's criterion, the two spectral lines are just resolved if the central maxima due to one spectral line falls over the first minima of the other.

The direction of the n^{th} principal maxima for wavelength λ_1 is given by,

$$(a+b) \sin\theta_n = n\lambda_1$$

$$\Rightarrow N(a+b) \sin\theta = Nn\lambda_1 \quad \text{——— (1).}$$

N is the total no. of lines on gratings.

The first minima in the dir^n $(\theta + d\theta)$ will be given by,

$$N(a+b) \sin(\theta + d\theta) = m\lambda. \quad \text{——— (2).}$$

m can take any values except 0, N, 2N ...

Therefore the first minima adjacent to the n^{th} maxima in the direction $(\theta + d\theta)$ is possible only when $m = nN + 1$. Hence eq^n (2) becomes,

$$N(a+b)\sin(\theta+d\theta) = (nN+1)\lambda. \quad \text{--- (3)}$$

The direction of principal maxima of the diffraction pattern due to wavelength $(\lambda+d\lambda)$ in the dir^n. $(\theta+d\theta)$ is given by,

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

$$N(a+b)\sin(\theta+d\theta) = Nn(\lambda+d\lambda) \quad \text{--- (4)}$$

For Rayleigh's criterion to be satisfied, the principal maxima of wavelength $(\lambda+d\lambda)$ should coincide with the first minima of wavelength λ in the same dir^n $(\theta+d\theta)$.

Hence comparing (3) & (4),

$$(nN+1)\lambda = Nn(\lambda+d\lambda)$$

$$\lambda = Nnd\lambda$$

$$\boxed{\frac{\lambda}{d\lambda} = n.N}$$

Hence,

$$\boxed{R.P. = \frac{\lambda}{d\lambda} = n.N.}$$